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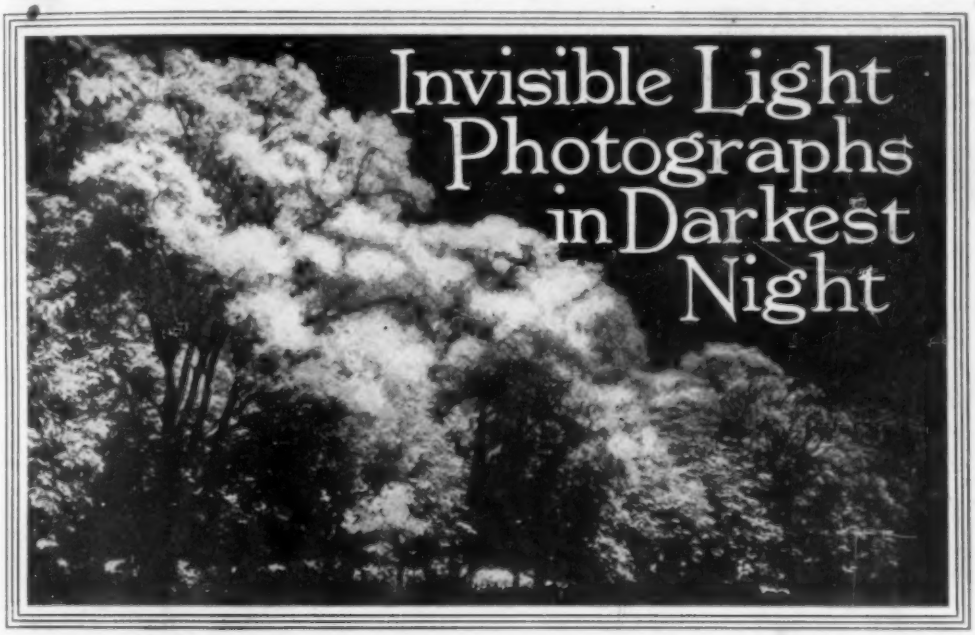


Beautiful Snow Effects Are Obtained by Professor Wood in Photographing Green Trees and Grass by Invisible Infra-Red Rays, Which Lie outside the Visible Spectrum

Pictures by Unseen Rays and of Unseen Objects One Hundred and Fifty Miles Away Achieved by Quartz Lamp and Lens

INVESTIGATION of an announcement from Tokyo recently that Jusei Sugiye, a Japanese scientist, had succeeded in taking photographs in the dark by an invisible light revealed one of the wartime secrets of the U. S. navy which helped guide the ship convoys across the ocean at night without visible lights, which would have betrayed them to submarines.

The same invisible light used by the Japanese scientist was employed in war time to enable the ships to keep their places in line and Dr. Harvey Brace Lemon, of the University of Chicago, who recalled the war stunt, has duplicated in his laboratory the Japanese achievement.

The invisible light is obtained by passing the rays through a black glass impervious to all but the ultraviolet portion, which cannot be seen by the eye. Lights, sheltered behind this black glass, on the stern of each convoy ship were invisible, but the next ship in line could see it by focusing on it a telescope in which was fixed a small fluorescent screen, like the screen used to make X-ray pictures visible.

Ordinary glass will not pass ultraviolet rays—which is the reason sun cures must be taken in the open air, or behind a window of quartz. To take pictures by the invisible light, it is necessary not only to have the special black glass, but the light behind it must be inclosed in a quartz tube in order that the ultraviolet rays may escape.

In the experiments made by Dr. Lemon a small mercury-vapor lamp in a quartz globe was used, the lamp being mounted in a wooden box, with a sheet of the black glass in front. A subject posing before it for a photograph becomes visible because his eyeballs, fingernails and teeth become fluorescent, shining in the

dark, and in some cases even the skin and hair show similar activity.

The eyes have a peculiar sensation of receiving a bright light, though none is visible, and if the head is lowered to take the eyes out of the ultraviolet beam, the sensation disappears so suddenly that it feels as though a nerve has been severed.

Even the fairest skin, devoid of freckles, photographs covered with dozens of them, for every place where the pigment of the skin has a latent tendency to freckle, if exposed too long to the sun, the concentrated invisible rays pick out the difference and imprint it on the photographic plate.

Camera plates are so sensitive to the rays that they easily become fogged from exposure. In absolute darkness, with the camera at one side and behind the light source to protect the plate, a second's exposure is sufficient for a picture. Pointed at the light source, the black glass becomes transparent to the camera, though not to the human eye, and the plate records a picture of the hidden apparatus within the light box.

Fluorescent liquids glow in the dark as they pick up the invisible rays. Water with a small amount of esculin dissolved in it remains clear and pure to the naked eye, but exposed under the ultraviolet rays, it flares with a brilliant ultramarine, only to turn again to clear water when taken away. The invisible light can be used not only to take pictures in the dark, but will photograph invisible objects miles away. At Lick observatory, in California, Prof. Wright has succeeded in taking pictures of redwood trees on the Sierra mountainsides 150 miles away, every detail of the trees showing clearly. A quartz lens, heavily coated with silver, to keep out all visible light, was used in a camera made of apparatus used to photograph distant stars. With the same lens, it is possible to send up an airplane and hide it in a cloud, so that it becomes invisible to the people on the ground, and yet take pictures showing every detail of the ground, since the invisible rays pass through the cloud without interruption.

Remarkable rainy-day and fog effects can be produced in out-of-door photography with the ultraviolet rays. Prof. Lemon has been experimenting for several years with them.

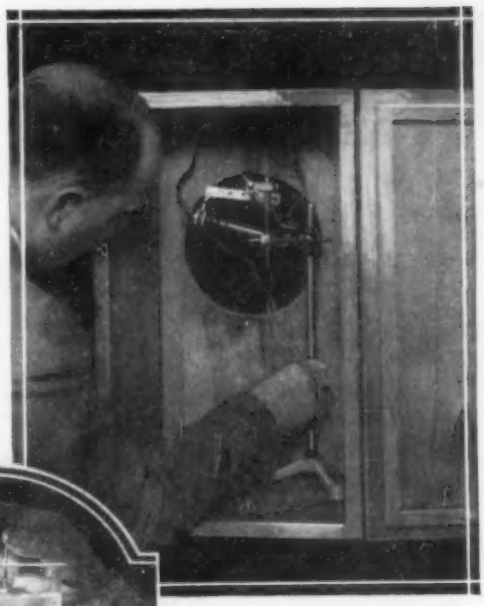
Another experimenter, Prof. Wood of Johns Hopkins university, is working at the other end of the spectrum, photographing by the infra-red rays, which are below the band of visible reds. Pictures of green trees and grass taken by this light turn out wonderful snow effects, the greens photographing white.

The study of the invisible rays at either end of the visible spectrum, whose colors unite to form white light, is still in its in-

Eyeballs and Teeth Become Fluorescent under the Ultraviolet Ray, and Invisible Freckles Appear; Picture Taken in the Dark by Invisible Light, at Left, and in Ordinary Light, at Right

fancy, though the last missing band of wavelengths has finally been measured. With new chemical combinations for their plates and better equipment, research workers are constantly extending the field of photography into things the eye cannot otherwise see.

Investigation of invisible light has received considerable impetus within the past few months by the discovery of a process for producing crystal quartz cheaply and in quantities, and by revelation of the healing power the rays possess. Because of the relative cheapness of quartz produced by the new process, entire windows of the material have been made possible, the first being installed at Johns Hopkins. Experimenters in recent months have discovered that the ultraviolet rays will cure such diseases as rickets, common particularly among children in crowded tenement districts where little sunlight penetrates. Experiments on chickens showed that fowls confined in hothouses under ordinary window glass failed to attain their growth, sickened and eventually died of rickets, marked by failure of the bones to develop. Other chickens exposed for only a few minutes daily to ultraviolet rays thrived.



Mercury Lamp in Quartz Globe and Black Glass, Which Passes Only Ultraviolet Rays. Above; Water with a Small Amount of Esculin, at Bottom, Remains Clear as Crystal, but Becomes Fluorescent under the Rays, Center

In the hands of an inexperienced person the rays, however, are a source of danger. Only a few minutes' exposure is sufficient to produce a bad case of sunburn, while the eyes may be injured unless protected by goggles. The special black glass used in laboratory experiments is designed to pass rays on the borderland of visibility, to lessen the danger of burns and the bad effect on the eyes.

Beyond possible use in war time, in photographing enemy troop concentrations without their knowledge, no use has yet been found for photography by ultraviolet rays, but the reaction of pigment in the skin to the invisible light may some day make it valuable in the study of skin disease. Even now it is a good test of the origin of one's teeth, since only your own become fluorescent under the rays. Fillings, crowns and false teeth remain dark and loom up as gaps in the finished picture.

PITCH OF FIRE-ALARM SIGNAL TELLS LOCATION OF BLAZE

One of the Triangle Fire-Alarm Signals That Tell Location of Blaze by Their Pitch

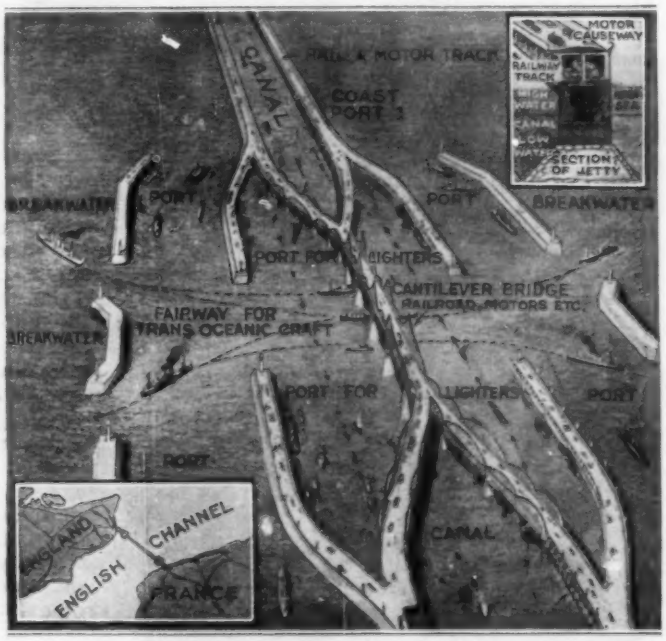
Volunteer firemen in a Maryland town determine the approximate location of a blaze by the pitch of the alarm, the clang of a triangle, beaten by an iron rod. There are four such signal instruments, each in a different section of the village, and each varies in pitch by several notes. A little practice and a fairly acute sense of hearing and music, enable the volunteers to rush the hose cart and other apparatus to the scene of the fire with the least possible delay.

FAST MAKES BRAIN MORE ACTIVE

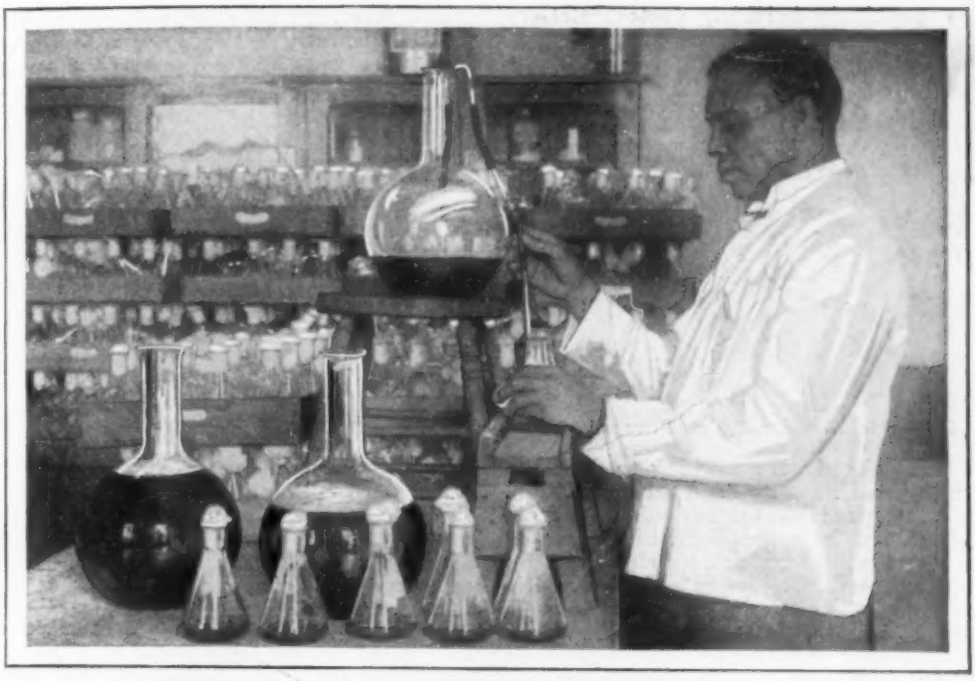
Prolonged fasting retards mental ability and alertness, but the brain's efficiency suddenly increases, often above normal, when eating is resumed, tests conducted at the University of Chicago show. Three subjects were chosen for the experiments. One of them went without eating for thirty-three days, one for seventeen and the other for ten. Hands were steadier and the brain keener after the fast than before. Seven tests were given, such as reading clippings from a magazine backward; naming 1,200 mixed colors; writing the letters "ab" for twenty minutes; reading various kinds of type in a dark room under a standard light; testing the steadiness of the arms, and standing at attention for a given length of time. The tests were made during the fast, at its conclusion and from twenty-three to thirty-three days thereafter. The subjects kept diaries in which they recorded their sensations and experiences. Most of their dreams were about food.

SHIP CANAL BETWEEN BRIDGES ACROSS ENGLISH CHANNEL

Suggested by a Swiss engineer as a substitute for a tunnel, a bridge over the English channel would be constructed in the form of two parallel jetties with a canal for ships between them. It is estimated that the work would cost $350,000,000. Spans near each end would be erected to permit the passage of boats, and the breakwaters protecting these points could be used by lighters for loading and discharging cargoes. Each jetty is to provide a double railroad track with a motor highway above.



Drawing of Suggested Jetties over English Channel, Showing Canal for Ships, Spans, and the Protected Areas for Ports



In a Germ-Culture Laboratory; the "Chef" Is Preparing Beef Tea to Feed His Hungry Charges Which Are Being Raised for Experiments and for Helpful Vaccines

Raising Germs to Guard Your Health

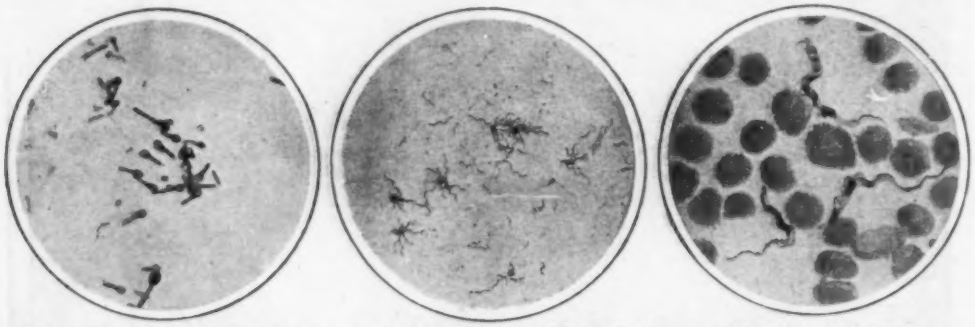
Disease-Preventing "Bugs" Are Pampered with Many Luxuries and Have Special Chefs to Cook for Them

GERMS are popularly regarded as harmful, but science rates them so highly that thousands of dollars are spent annually to raise certain varieties for the preparation of vaccines and serums, to save human lives and for experimental purposes. An institute in London keeps about 2,000 kinds on hand for sale. Millions of germs may be purchased for a few cents, depending upon the species. They are shipped to all parts of the world to supply physicians and hospitals.

Some laboratories devoted to germ culture employ special "chefs" to prepare food for the organisms, many of which are so tiny that 500,000 or more may be contained in a single drop. Their diet consists of animal and vegetable gelatin, glucose and beef tea, either with or without sugar. When the germs are properly developed, they are washed off the substance in which they have been raised, thoroughly shaken and counted. This is done with the aid of a microscope by placing them on a ruled glass divided into small squares. By counting the number of germs in one of the sections and multiplying the result by the number of squares in the total area, the correct number is closely estimated. This is important, for the number of germs determines the strength of the vaccine, which is administered in carefully measured amounts to insure beneficial effect of the treatment.

Before the germs are ready for use, they must be killed. This is accomplished by heating them to about 180 degrees Fahrenheit for thirty minutes. They are then placed in a salt solution and made ready for the shipping containers. Administered as a vaccine, the dead germs stimulate the white corpuscles of the blood to combat the disease germs, preventing their multiplying in the system. This is what occurs in the treatments for preventing typhoid fever, pneumonia, boils, whooping cough and other diseases for which vaccines are available. The preparations are of little aid, in fact may

be positively harmful, doctors declare, if given after the disease has been contracted, for the reason that the white corpuscles already are working to fight the enemy and need no artificial stimulation.



Left to Right, Lockjaw, Typhoid Fever and African Sleeping-Sickness Bacilli, Each Magnified 1,000 Diameters

A serum is not made directly from germs, but from the blood of a horse or other animal to which a vaccine has been administered. It acts as a poison and is intended to combat the disease germ directly as in lockjaw and diphtheria.

Preparing food for the germs requires the utmost care in order that foreign microbes may not contaminate the vaccine. It is thoroughly sterilized, weighed and measured and kept at an even temperature in bottles sealed with cotton. Often the kind of food on which the germ thrives gives a clue to its identity.

As a check against mistakes and before a germ is admitted to "recognized standing" in the scientific world, four tests have been applied. First of all, the germ must be found, it must then be reproduced by culture in some medium, inoculation must show that it really produces the disease it is supposed to cause, and after that, the germ must be recovered from an animal or person suffering from the disease. By this cycle of tests, the nature of the germ is established and it can be raised with a certain degree of assurance that it will produce the expected results. Many germs under cultivation in laboratories have not yet passed these tests. Among these are the influenza germ and that which causes smallpox.

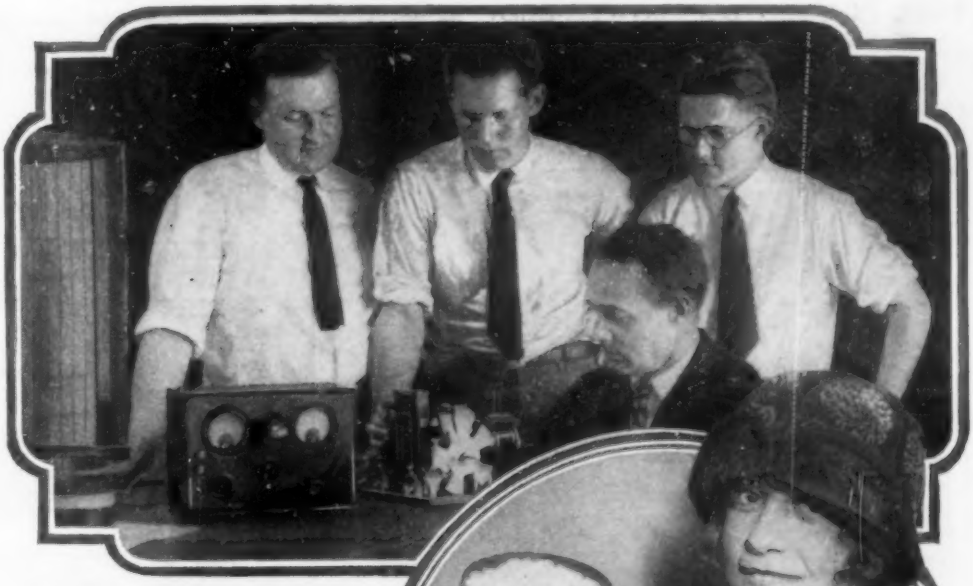
Evidence of the effectiveness of these beneficial microbes in saving human lives is plentiful, but figures gathered by Dr. C. C. Pierce, director of the third district of the United States public health service, from army records are cited as proof of the value of the use of such means of combating disease, a method which has been practiced in the fight against typhoid fever, for instance, only since 1904 in this country. During the Spanish-American war, before the typhoid-fever vaccine was used, one man out of every six of the 175,000 called to the colors contracted the disease, and there were 1,580 deaths. In the World War, with nearly 4,000,000 men in the service, only one out of every 3,800 contracted typhoid, and there were but 213 deaths from it.

Some of the varieties of germs under cultivation are so delicate that they must be kept at constant temperatures day and night. Some thrive best on food in which egg is a chief ingredient and others manifest a taste for alcoholic substances.

FORT TURNED INTO LIGHTHOUSE TO GUIDE NIGHT FLYERS

Inland lighthouses, like those that direct ocean vessels from points of vantage near the shores, have been established in France to guide night traffic by air. They supplement landing field signals and are intended to prevent such accidents as occurred in this country not long ago when Pilot Charles H. Ames of the mail service crashed into a mountain top in Pennsylvania. Two beacons already have been erected, one at Paris, and the other at Dijon, the crossroads of the air lanes. In the latter city, the lamps, of 1,000,000,000 candlepower, capable of throwing their rays more than 200 miles on clear nights, have been installed in the tower of an old fortress which stands on the summit of a hill. Reserve motors and transformers have been placed in the lower part of the structure, and the light is reached by winding stairs to the top of the tower. The lamps are fixed upon two revolving platforms and can be adjusted to give either two or four shafts of light. Sometimes the beams appear to sweep the horizon like the huge arms of a horizontal windmill.

Latest Developments in Field of Science



Multiple System of Radio Transmission Promises New Usefulness for Wireless; Eight Telegraphic Code Messages Were Broadcast Simultaneously on This One Transmitter and All Were Registered on a Single Receiving Set; the Process Involves a Short Carrier Wave at 30,000,000 Vibrations per Second on Which Are Impressed Several "Modulatory Waves"

"Snow" with Temperature of 110 Degrees below Zero Frozen from Liquid Carbon Dioxide, and at Left, Safety Mask Which Protects Eyes, Mouth, Nose and Ears in One Unit

Examining Specimens of Pure Metallic Thorium, Sought for a Century and Now Produced by a New Method; the Substance Is Prepared in the Form of Rods, Wires, Filaments or Powder and Is Expected Greatly to Improve X-Ray Appliances and Radio Tubes

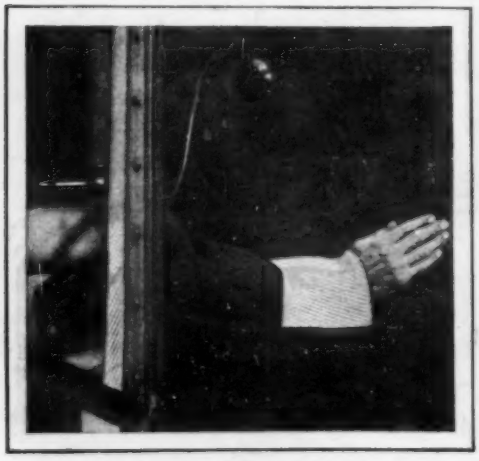
TIME IS TOLD BY FLOWER-BED PLANTED ON CLOCK DIAL

One of the sights at Interlaken, Switzerland, is a flower-bed clock. The blossoms have been planted over the dial of a real timepiece, which is tipped up so that passers-by can see the position of the hands. Numbers of the hours are plainly visible against a dark background, and the orbit of the tiny second hand is divided into four sections, each indicating a quarter of a minute. The clock is in a sanitarium garden where it may be consulted by doctors and patients.

Flower Clock at Interlaken, Switzerland; Works Are Below the Dial and Turn Real Hands over the Blossom Numbers

WHITE CUFFS FOR BUS DRIVERS AID NIGHT SIGNALING

So that their hand signals may be seen more easily both by day and night, the uniforms worn by London bus drivers are being fitted with broad white armlets that extend from the wrist nearly to the elbow. They are particularly plain at night when light is directed upon them, giving ample warning to drivers behind to prepare for the turn or stop of the bus.



Cuff Attracts Attention to Arm Signals

SAFETY GAS TANK PUNCTURE AND FIRE-PROOF

Although penetrated by explosive and incendiary bullets, a gasoline tank for an airplane did not catch fire or even leak after tests in Vienna. It was of the usual metal type, but was lined with a secret composition something like the material placed inside automobile tires to prevent punctures. A special mechanism inside the container eliminated the effects of the explosive projectiles. Flaming bullets were instantly coated with the lining material on piercing the tank. This extinguished the blaze and also prevented phosphorus-coated bullets from leaving a deposit. After twenty rounds of ammunition had been fired into the tank without any bad results, it was placed in the airplane which then made an hour's flight, using only gasoline from the apparently perforated tank. No leak, fire or other trouble occurred.

MOCK TRIAL IN MODEL COURT TESTS LIGHT AND SOUND

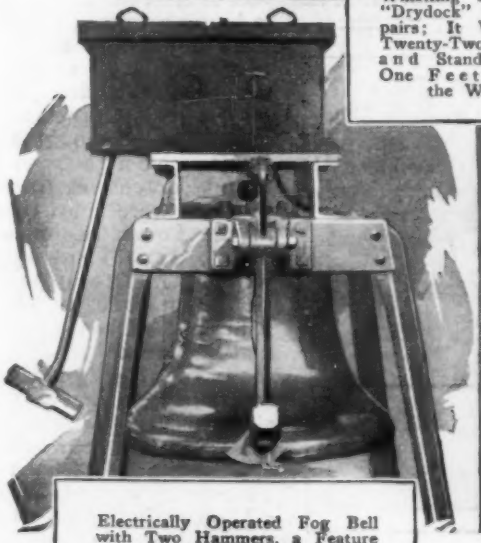
Before the wheels of justice were started in a St. Louis court, a jury of judges, lawyers and building experts sought the best ventilation, light and acoustical properties for the courtroom by staging a mock trial. Theater trappings were borrowed and an area, the size of the room as it would be when finished, was walled off. A court stenographer, clerk and volunteer jury were arranged in their usual locations. As the trial proceeded, if the judge's desk seemed improperly placed, it was moved; witnesses and stenographers were shifted and the jury box was changed to afford its occupants the best opportunity to hear. Results of the tests were incorporated in a model plan for all the courtrooms in the building.

Behind Scenes in the Lighthouse Service

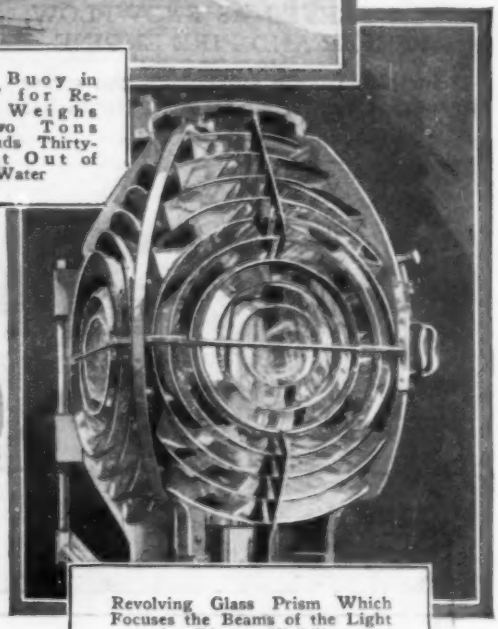
Putting New Superstructure on the Cape Charles Lightship, a Floating Steamer Guardian

Operated by Compressed Air, This Siren Bellows Fog and Storm Warnings

Whistling Buoy in "Drydock" for Repairs; It Weighs Twenty-Two Tons and Stands Thirty-One Feet Out of the Water



Electrically Operated Fog Bell with Two Hammers, a Feature of Up-to-Date Lighthouses



Revolving Glass Prism Which Focuses the Beams of the Light for Distant Visibility

© Keystone

SPECIAL HARP FOR JAZZ MUSIC PLAYED LIKE GUITAR

Features of the harp and the guitar are combined in a special instrument that has

Playing the Six-Stringed Jazz-Band Harp-Guitar; Its Size Commends It for Orchestra Use

appeared in London for jazz bands. It is played with pick and steel, has six strings, and the shape of the sounding chamber is said to produce effects particularly suited to modern dance music.

TRUCK SERVES AS SNOWPLOW, SWEEPER AND FIRE ENGINE

Principles of the snowplow, the street sweeper, sprinkler and fire extinguisher have been combined in a motor truck introduced in Germany. The shovel is carried on a frame in front and can be adjusted to various heights and angles, while water for cleansing the pavements and sidewalks is forced out through vents from a large supply tank. Hose connections are provided, when the truck is to be used for fighting blazes.

Combination Truck in Action; Plow for Scraping Snow or Dirt in Front, Street Flushers at Sides, Operated by Powerful Pumps

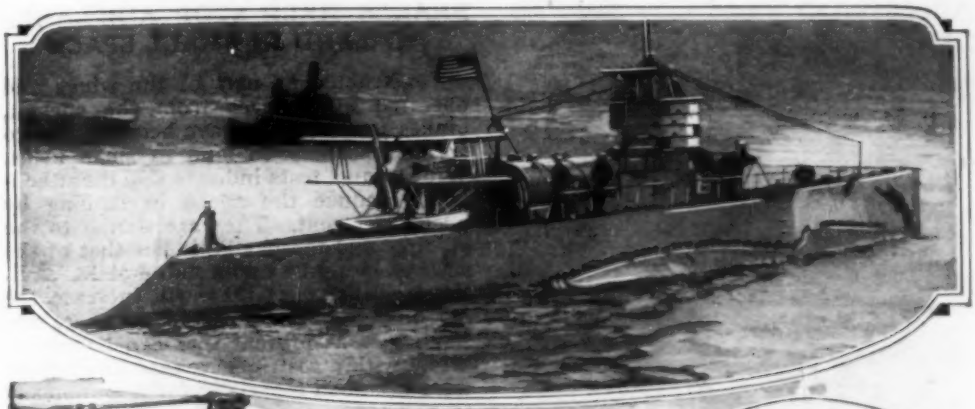
PLANE CARRIED ON SUBMARINE IN CIRCULAR TANK

Submarines may carry their own airplanes to help direct torpedo fire as a result of naval experiments. A circular tank, similar to those used in transporting oil was installed on the deck of the submarine "S-1," and a hydroplane, with its wings removed, stowed into it. When the "sub" had risen to the surface, the end of the tank was removed, the wings attached and the plane made ready for flight. The limited space on the deck of the submarine added to the difficulty of the experiment, but this is not considered a serious hindrance to the success of the plan.

CLUE TO "MISSING LINK" FOUND IN SKULLS CENTURIES OLD

Discovery of mammal skulls, probably 10,000,000 years old, in the Gobi desert of Mongolia, may help link the life of the present with that of the remote past, scientists believe, and further strengthens the theory that that part of Asia was the cradle of existence. The bones belonged to animals about the size of rats that lived at the supposed transition period between reptiles and mammals. Although no human bones were found, extensive traces of man were unearthed in the form of implements, drawings and weapons. The expedition, sponsored by the American Museum of Natural History, also found a huge petrified forest in Asia that probably was the ancestor of the California redwoods, and obtained what is considered conclusive evidence that Mongolia is the oldest continuously dry land in the world.

Submarine Serves as Airplane Carrier



Seaplane on Submarine Deck Ready for Flight, and View of Storage Tank with End Removed to Show Nose of Plane Tucked Away After Wings Were Taken Off

Tackle for Lifting Plane So That Wings May Be Attached or Unfastened for Storing, and Ship on the Water; to Launch It, Submarine Simply Ducks and Leaves It Floating

Forester Taking a Close-Up Aerial View with Aid of Special Tripod to Show Vegetation

CAMERA IS HUNG FROM TRIPOD TO TAKE PHOTOS VERTICALLY

Foresters in the Crater national reserve in Oregon use a portable tripod arrangement in taking pictures to show the ground conditions of the area. The camera is suspended from a pole supported by the tripod and is hung in such a way that the lens points directly downward. The height of the pole is easily adjusted and, with the distance known, the camera can be focused accurately. Exposures are made by pressing the bulb to avoid jarring the instrument. The resulting photographs are virtually close-up aerial views and give detailed analysis of vegetation, soil conditions and growth of young trees far more completely than would be possible in pictures taken at an angle, foresters declare. The area included in the exposure can also be determined.

BRAKES HELP STOP AIRPLANES TO LAND IN SMALL SPACE

Constructed as part of the wings and operated by a lever from the cockpit, brakes for airplanes have been devised to permit the ship to land in small fields. Wind-tunnel tests indicate that the attachments reduce the speed in landing by twelve per cent. They are similar to the ailerons and the handle is like that of the emergency brake on an automobile. Aviators predict that they will increase the usefulness of the airplane, as there are few styles at present that can be landed safely within restricted areas. The brakes were designed especially for a monoplane to be used in aerial photography. It will carry five passengers, has a camera cabin with darkroom, and tanks for water, for developing and washing the pictures while on flights, are installed in the wing. If the brakes prove effective, landings for quick delivery of photos can be made.

ROLLING HOME WITH SIX ROOMS RELIEVES HOUSE SHORTAGE

Portable houses equipped with modern conveniences have appeared in Nice, where the annual influx of tourists taxes the hotels. The homes are designed like cars, occupy but small space and contain a living room, dining room, bathroom, two bedrooms and kitchen. They are easily hauled and, when in use, are anchored by stout supports on the sides and ends.

All the Comforts of a Hotel on the Sidewalk; Rolling Six-Room Home for Tourists Visiting Nice

WEDDING RINGS OF OLDEN DAYS MADE OF AGATE AND IRON

While sentiment has demanded that wedding rings should be made of the most precious and durable of metals, wives of the ancient Romans sometimes wore bands of iron as a token of ownership or fidelity, and some of the earliest rings were of agate. Since platinum has superseded gold in value, rings of this metal are common. Gold rings were worn by the Egyptians as early as 2000 B.C., but they had no matrimonial significance. The symbols indicated orthodoxy in the households of the early Christians, and finger rings were first used as seals to identify papers. In America, rings were not always popular. The Puritans believed that they were too suggestive of charms.

CANDLE THAT BURNS KEROSENE SERVES AS VAPORIZER

Resembling a candle set in a metal holder, a small lamp that burns kerosene, gives practically the same illumination as a tallow taper without the bother of frequent renewals and untidy wax. The upright portion is a cylinder containing a wick and a chamber for the fuel. The height of the flame is regulated by means of knobs on the side of the chimney base, and if needed, a small basin of disinfectant may be placed above the light on a special holder so that its vapor will purify the air. The shades are decorated with a number of patterns and colors and some are equipped with a tiny heat "motor" so that they revolve when the lamp is lighted. The glow is sufficient for a sick-room night light.

Candle Lamp with Revolving Decorated Shade; Pan of Disinfectant May Be Set on Chimney

GARAGE FOR BABY CARRIAGES SERVES CITY FAMILIES

Forty-three families in a model tenement in New York have a common garage for their baby carriages. It is a low, waterproof shed, with padlocked doors, in a convenient court and spares the mothers the trouble of taking the vehicles to their apartments. Each family contributes five cents a week toward the rent and maintenance of the garage.

One Solution of the Small-Apartment Problem; Community Baby-Carriage Garage, Readily Accessible in Court and on Street Level

RESEARCH WORK BY INDUSTRIES SAVES HALF BILLION YEARLY

American manufacturers spend nearly $35,000,000 each year in research work, according to estimates prepared by the United States chamber of commerce, but the investment is said to save $500,000,000 annually in the conduct of industry. Many of the large trade associations spend more than $20,000 each every year to find out how to improve their business. A canners' organization is reported to have an annual budget of $120,000 for this purpose, and a building-material association spends $100,000 for work of this kind including laboratory experiments.

Arrival of the Motor Cavalcade on the Shores of the Indian Ocean after Crossing Africa from the Mediterranean Coast; This Section Reached a Kenya Colony Port

Through Darkest Africa by Motor Car

French Expedition, in Eight Machines with Caterpillar Treads for Rear Wheels, Links Ends of the Continent in 12,000-Mile Dash

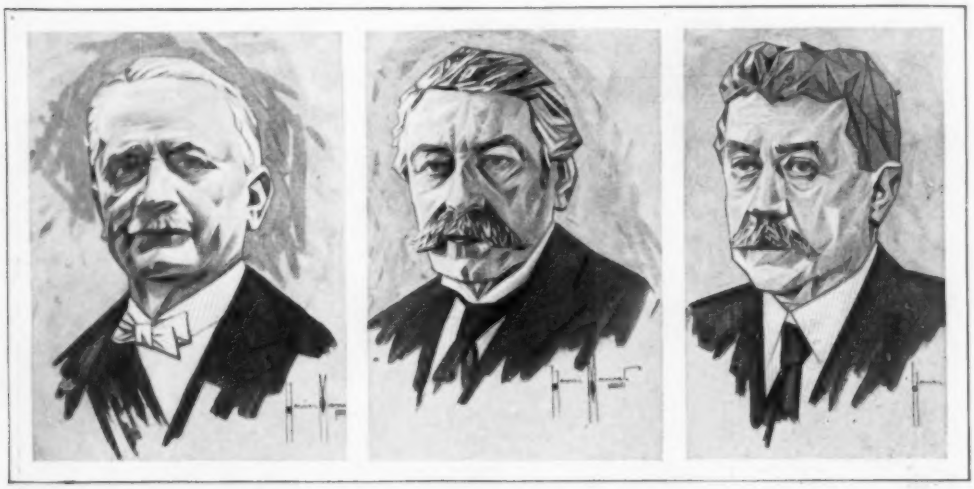
LINKING Algeria and Morocco, on the Mediterranean shores, with Cape Town, at the southern tip of the continent, and Daressalam and other towns of the Indian ocean, a French expedition of seventeen explorers, has come out of the jungles after taking motor cars where they had never been seen before.

The equipment included eight specially designed automobiles, with standard front wheels and balloon tires, but with caterpillar tread in the rear. They were so loaded that each two cars formed a separate self-sustaining unit. After starting from Colomb-Bechar, on the Morocco-Algeria frontier, and traveling more than 5,000 miles together, two cars left the others at Kampala, on Lake Victoria, near the headwaters of the Nile, and traveled eastward along part of the route Stanley took when he was hunting Livingstone. They crossed Uganda and Kenya colony, and finally reached the Indian ocean at Tanga and Mombasa.

The other six continued south across Lake Victoria to Mwanza and then on to Tabora, in the Tanganyika territory, where the party split in three parts. One pair of cars went east, 400 miles or more, to Daressalam, on the Indian ocean and another south to Lake Nyasa, down the west side of the lake, rounded its lower end, and by way of Zomba continued on to Mozambique on the Indian ocean.

The remaining unit branched west from Tabora into the Belgian Congo, through a region of steaming equatorial jungles and reached Kabala, a Belgian military outpost. From there they followed up the Ludlaba river, moving south to Elizabethville, named after the Belgian queen, and eventually reached northern Rhodesia at Broken Hill. From there on the journey lay through the British section of south Africa, crossing the lands of the once warlike Matabele by way of Bulawayo, their old capital, and into the Transvaal to Pretoria and Johannesburg. From the old Boer towns the route led southwest to Kimberley and to Cape Town.

Natives Stared Wide-Eyed as the First Automobiles They Ever Saw Dashed through River Beds; Below, a Scene on the Edge of the Sahara Desert When Arab Tribesmen Gathered to See the Gasoline Caravan



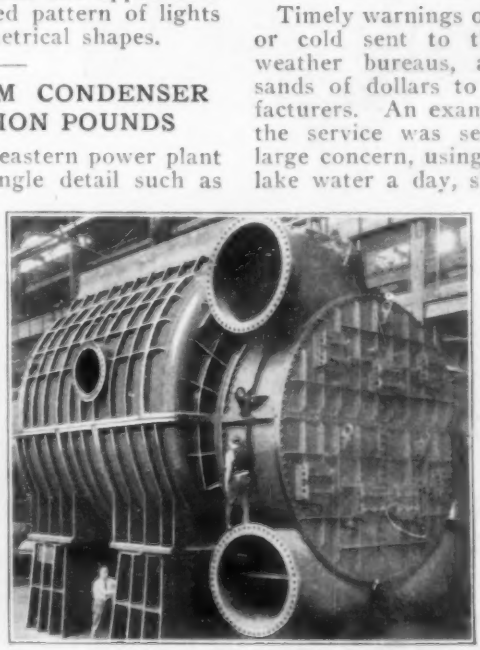
Cubist Photographs like Cartoons, Emphasizing the Traits of Three Prominent Men of France; from Left to Right, President Doumergue, Aristide Briand and M. Painleve

PHOTOS TAKEN IN CUBIST STYLE REVEAL CHARACTER

By a process of photographing the various planes of the face, and reproducing them in a composite portrait, a French artist takes pictures resembling cubist paintings. The method accentuates the features in such a way that the characteristics of the subject are emphasized. The finished picture has the appearance of a carefully arranged pattern of lights and shadows in geometrical shapes.

GIGANTIC STEAM CONDENSER WEIGHS MILLION POUNDS

The size of a large eastern power plant is illustrated by a single detail such as the condenser unit to convert exhaust steam from the turbines into water. It is nearly thirty feet high, weighs almost 1,000,000 pounds and contains more than fifty-one miles of tubes. When its two pumps are operated simultaneously, they have a joint capacity of 144,000,000 gallons of water every twenty-four hours, nearly half that of the combined waterworks and pumping stations of the city of Philadelphia. The main condenser has a cooling surface of 70,000 square feet. After the unit had been assembled, it was dismantled for shipping to its destination. Twelve condensers of this giant type are contemplated in the final plans of the huge power plant.



Huge Steam Condenser Weighs Nearly Million Pounds and Has Over Fifty-One Miles of Tubes

VALUE OF WEATHER FORECASTS SHOWN IN INDUSTRIES

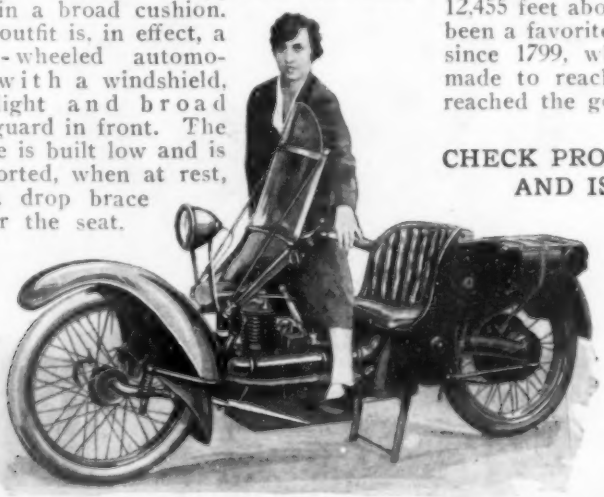
Timely warnings of approaching storms or cold sent to the public from the weather bureaus, annually save thousands of dollars to shippers and manufacturers. An example of the benefit of the service was seen recently when a large concern, using 27,000,000 gallons of lake water a day, shut down in time to prevent serious damage to its equipment because of a sudden fall in the lake level. Changes in weather conditions were noted by the observers who informed the company officials that a fall of a foot or more was likely between noon and evening. The prediction came true, but the machinery had been stopped in view of the warning and no harm resulted.

SPEED OF SIX MILES A MINUTE PREDICTED FOR AIRPLANE

After attaining a speed of 302.3 miles an hour, an unofficial world's record up to that time, with a 2,200-pound Curtiss racer, Lieut. Alford Williams, U. S. N., declared that he believed he could better that rate by nearly fifty miles. The tremendous momentum was gained by diving from a height of 3,000 feet and then "flattening out" on a straight course. A drop of 9,000 feet would permit the six-mile-a-minute pace, Lieut. Williams believes. The racing plane measured twenty-two feet from wing tip to tip, by nineteen feet eight and one-half inches long and eight feet one inch tall. The material in the wing-type radiators is thinner than the average sheet of paper, and water circulates at the rate of seventy-five gallons a minute. The propeller is of duraluminum. It is not damaged by rain, hail or tall grass and can be bent without breaking. To test the strength of the wings before the flight, bags of shot equaling the weight of fifteen automobiles were piled upon them, both when the plane was in a flying position and upside down. The cockpit is so sheltered that it would be impossible for the pilot to free himself, but a pull on a wire automatically opens it and allows the aviator to leap out.

MOTORCYCLE WITH CHAIR SEAT RESTS RIDER'S BACK

Motorcycles with chair seats have appeared in London, affording the rider greater comfort in a support for the back and in a broad cushion. The outfit is, in effect, a two-wheeled automobile with a windshield, headlight and broad mudguard in front. The frame is built low and is supported, when at rest, by a drop brace under the seat.



© Keystone View Co.
Comforts of the Automobile Are Enjoyed in This Motorcycle with High-Backed Seat and Windshield

IRON CROSS TEN FEET HIGH MARKS MOUNTAIN TOP

Defiant of Winter Storms, Iron Cross, Guyed to Rocks, Caps Alpine Mountain Crest

Strongly anchored to the rock, a ten-foot iron cross marks the wind-swept summit of Gross-Glockner, an Alpine peak on the borders of Salzburg and Tirol, 12,455 feet above sea level. The peak has been a favorite objective of mountaineers since 1799, when the first attempt was made to reach its top. Some peasants reached the goal the following year.

CHECK PROTECTOR FITS FINGER AND IS WORN AS RING

Worn as a finger ring, a check protector devised by an English business man has sharp, milled edges that puncture the paper in any desired direction. It is designed as a substitute for more costly outfits, and is used by laying the check flat, clenching the fist and drawing it across the slip. The ring, being loose-fitting, turns on the finger as a wheel.

Bird "Apartment House" Made Secure from Cats by Tin Sheeting Wrapped around Tree Trunk

TIN BAND AROUND TREE TRUNK KEEPS CATS FROM BIRDS

Cats cannot reach birds in a commodious "apartment house" an eastern man has built for them, as the supporting tree is bound with a band of tin, presenting a surface too slippery for the marauders to climb. The house has room for many inmates, and besides the usual nesting places, has a replica of a garage and a filling station to make it up-to-date. The birds apparently know that cats cannot reach them in these shelters and flock to the house in great numbers each season.

DEADLY WAR GAS PROTECTS PLUMES

Poison gas was used to guard a case of costly plumes of the bird of paradise and other rare fowls shipped to a museum in Baltimore, Md. A sign on the outside warned, "to open this case is to court death." Thus anyone bent on stealing the valuable contents would have only himself to blame if he came to grief by tampering with the package.

ELECTRIC-POWER LINE TO LINK CITIES OF SIX STATES

A 182,000-volt transmission line between South Bend and Michigan City, Ind., will link Chicago with cities in Ohio, Indiana, Pennsylvania, West Virginia and Kentucky, enabling centers to borrow power from each other in emergency, as well as providing a means of interchange between plants in the same city during peak hours. The line is expected to be opened next March. It is considered one of the largest links in the proposed interlocking of power plants throughout the nation. The cables are strung on steel towers nearly 100 feet high, and the erection of two huge generating plants, one of 120,000 and the other of 2,000,000-horsepower capacity, is included in the project.

TOBACCO-LEAF COFFEEPOT IS FAIR ATTRACTION

Among the exhibits at a Georgia fair was a realistic coffeepot woven of large tobacco leaves, the product of one of the counties of the state. Held at an angle as though liquid were being poured from it, the display attracted much attention.

Model of Coffeepot Woven from Broad Tobacco Leaves as Exhibit for Georgia Fair

Jagged Piles of Ice Repel the Supply Tug and Make Landing on the Water Cribs a Difficult Task, While Often the Floes Block the Lake for Miles and Render Aid Impossible

Icebound in Sight of City's Lights

Keepers of City's Water Cribs Frequently Storm-Bound for Month or More in Plain View of Teeming Millions Ashore

STORM-BOUND for day after day, with food supplies running short while, three miles away, millions of people are going about their daily business, is a frequent winter experience of the men who man the water cribs in Lake Michigan, off Chicago's lake front. By night, when thousands of lights gleam along Michigan avenue they can pick out the brilliantly lighted hotels and restaurants, where hundreds are dining, and watch the endless procession of moving automobiles whose occupants are bound from home to dinner, from dinner to theater, and then on to a midnight supper.

The water cribs are the intake pipes of the city's water system, connected with shore by huge tunnels driven through the solid rock far below the lake bed. A powerful tug, formerly in the navy's seagoing fleet, acts as tender and carries supplies to the crib crews, but every winter there are recurring periods, when the ice floes are piled so deep off the harbor mouth that the boat cannot buck its way through.

When that happens, the crib keepers cut down rations and tighten their belts, for only a rising thermometer, accompanied by a shift of the wind from northeast to west or southwest can bring relief, and nobody knows when that will happen. Thirty and forty-day periods icebound on the cribs have happened, and two to three-week spells are quite common.

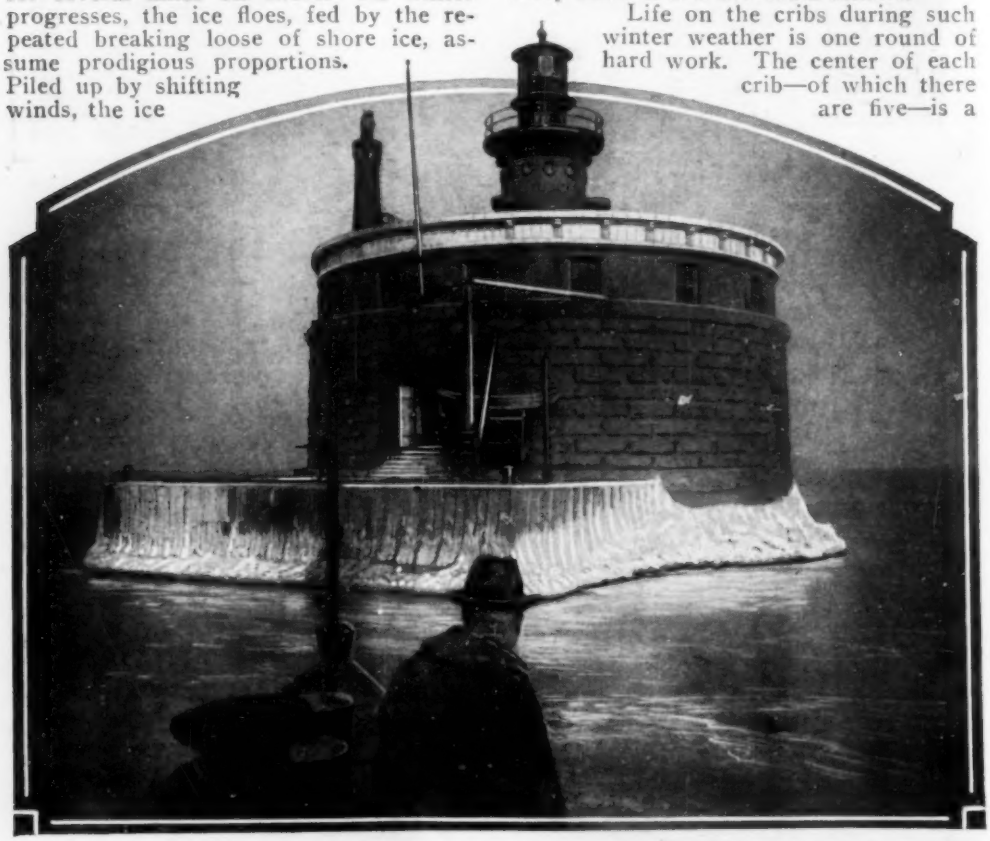
Ordinarily the crib keepers are relieved every week, getting a week ashore after each week at the water gates. In good weather, when such reliefs are possible, the tender tug gets around to each crib every couple of days bringing fresh meat and vegetables, newspapers and other sup-

plies to them. The upper end of Lake Michigan does not freeze over its entire expanse even in very cold weather, because the water remains warmer than the atmosphere. But along the shores, and at times for several miles out, ice forms in periods of calm, and breaks off to go cruising about the lake when the wind shifts and kicks up a storm. In the harbors and more protected spots, ice of six to ten inches' thickness is common, while one to two inches may stretch for several miles off shore. As winter progresses, the ice floes, fed by the repeated breaking loose of shore ice, assume prodigious proportions. Piled up by shifting winds, the ice field may reach a depth of several feet and cover an area of a hundred or more square miles.

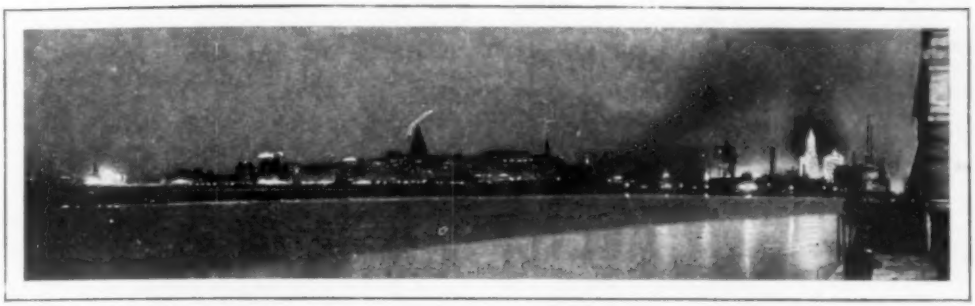
Barrels of Fresh Meat Are Hauled Ashore by the Hungry Crib Keepers

When the winter northeasters blow, the ice field is driven down on the Chicago shore and piles up for several miles out in the lake. A few years ago a steamer was icebound for two weeks six miles off Chicago's loop district, and the grinding ice wedged under it so much that the boat was lifted bodily a half dozen feet above the lake level. Coast guards with a lifeboat mounted on sled runners, and an airplane from a meat-packing plant delivered supplies to the unlucky seamen and averted a famine.

Life on the cribs during such winter weather is one round of hard work. The center of each crib—of which there are five—is a



One of the Stone-Walled Cribs in Winter; Often the Northwest Gales Will Send Tons of Green Water High over the Roof, Frequently Breaking the Windows Forty Feet above the Lake



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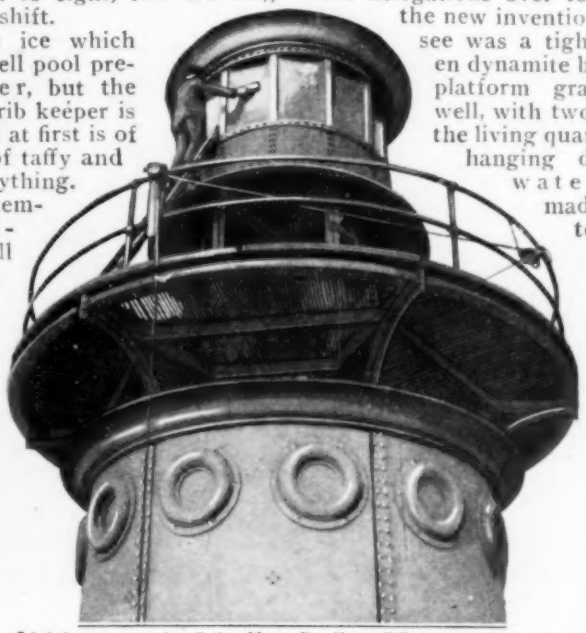
The Lonely Crib Keeper on a Clear Winter's Night Can See the Lights of the City Where Teeming Millions Are Living in Comfort at Home, Free to Go Where They Please

huge circular well, with thick stone walls. In the middle of the well the intake pipe from the tunnel to shore rises almost to the lake level. In the outer walls a series of portholes admit the water to the well, and it then flows down the intake. The well room is surrounded by a two-story circular house, with living quarters on the upper floor, forty feet or more above the water line. Despite their height, great green seas frequently break over the coping of the lookout balconies and go crashing through the rooms.

Three men man each crib in summer, when the only work to be done is cleaning the intake screens every couple of hours. But in winter, when ice constantly threatens to close the portholes and intake, the crew is increased to eight, two working on each six-hour shift.

Heavy surface ice which forms over the well pool presents no danger, but the bugaboo of the crib keeper is anchor ice, which at first is of the consistency of taffy and clings to everything. Under certain temperature conditions water will freeze to any obstruction, even though the current is considerable. When that happens, the portholes, intake pipe and every part of the underwater structure begin piling up with ice. A string dropped into the well pool and pulled up will be covered by a coating of ice. Then there is nothing to do but rout out the entire crew and set to work with pike poles and dynamite to break and blast away the ice. Dynamite broken into third-of-a-stick lengths is lowered four or five feet below the surface and exploded by electricity, the small charge being sufficient to break the ice loose without damaging the thick stone foundation.

One of the crib keepers, a couple of years ago, devised an "anchor-ice detector." While the other crib crews were standing constant watch day and night, the fortunate possessors of the detector turned in and slept soundly until an electric bell rang over the chief's bed and informed him ice was forming. Rival cribs sent delegations over to get the plan of the new invention. All they could see was a tightly closed wooden dynamite box resting on the platform grating above the well, with two wires leading to the living quarters, and a string hanging down into the water. Offers were made to buy a detector at any reasonable price—and declined. Surreptitious lifting of the box indicated it contained an amazingly heavy collection of machinery. Finally it was opened, and found to contain two small strips of brass and a quantity of paving bricks. The brass strips



Lighthouses on the Cribs Must Be Kept Efficient to Serve as a Warning to Shipping

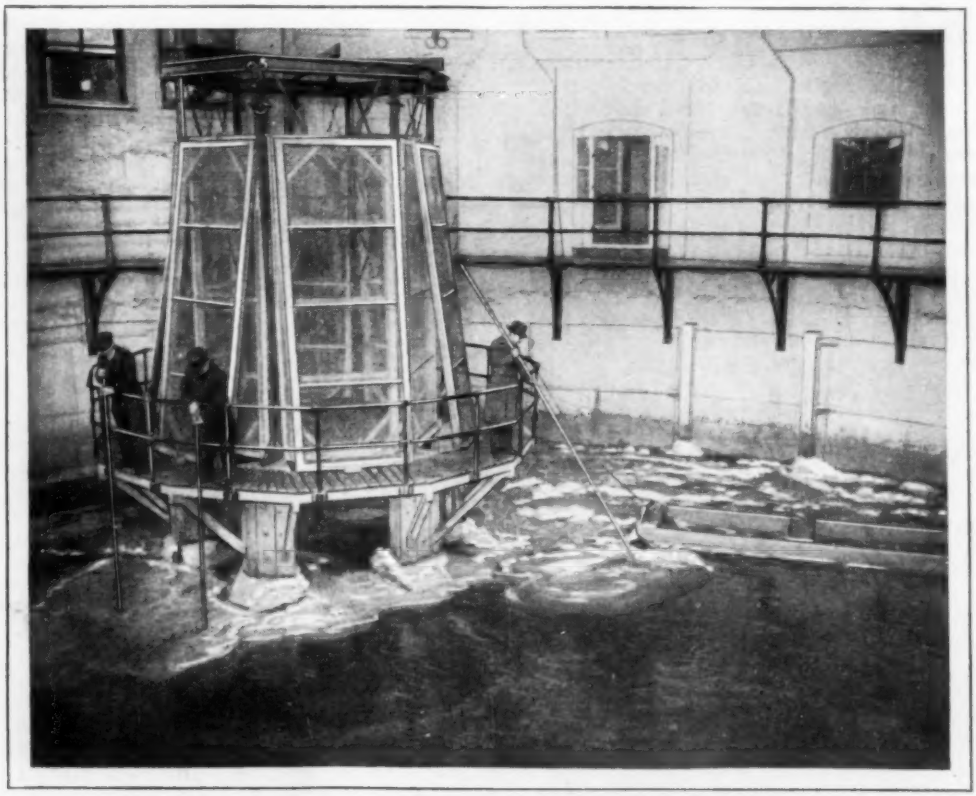
formed a switch, from which the string, weighted at the lower end with a few links of chain, depended. The weight was just sufficient to almost close the switch and complete the electrical circuit through dry batteries and bell in the chief's room. When anchor ice formed on the cord, the added weight closed the circuit.

Life on the cribs has brightened considerably since the invention of radio. Previous to that, communication with shore was confined to the telephone, reserved for official business, and the uncertain visits of the tug. Two years ago the city purchased a fine radio set for each crib, and now, day and night, the air keeps the men amused and in touch with events on land. A Chicago broadcasting station sends out news bulletins every half hour, so there is no longer any waiting for the tug to bring out the accumulated newspapers of past days.

The city feeds its "desert islanders" well. An enormously big ice box, placed out on the cold balcony, is kept filled in winter with all kinds of meats and fowls. A sample day's luncheon included two kinds of meat, peas, potatoes, salmon and boiled-egg salad, bread and butter, pie and coffee—and second or even third helpings are permissible. One of the noticeable facts on the cribs is that only the cook and his helper are kept thin by their work.

All refuse from the cribs is burned in incinerators instead of going down a sewer. The waste water from the kitchen sink and bathroom, which can't be burned, passes through a chemical plant for treatment, and a city health officer makes frequent visits to take samples and see that the treated water is absolutely free from dirt and germs.

Tending the city's water gates is only a part of the crib men's work. Each crib is surmounted by a lighthouse with a fog bell, since they are obstructions to navigation, erected under war department permits, and subject to inspection by the lighthouse tender. The lights must be kept clean, the acetylene-gas supply working, and at the least trace of fog, the clockwork, which strikes the fog bell at ten-second intervals, must be put in motion.



When Ice Begins to Form around the Intake of the Tunnel Leading to the Water Works, the Entire Crew Must Turn Out with Pike Poles and Dynamite to Keep the Opening Free

HOUSE BUILT UNDER BUNGALOW TO SAVE MOVING COSTS

Instead of wrecking or moving a bungalow which stood upon his lot, a Los Angeles builder raised the structure on high "stilts" of wooden blocks and constructed an apartment house around and under it. The bungalow was incorporated into the larger unit as part of the top floor and could scarcely be distinguished from the rest of the finished house. Uniformity and harmony were achieved by modeling the front part of the apartment's upper story after the pattern of the original bungalow.

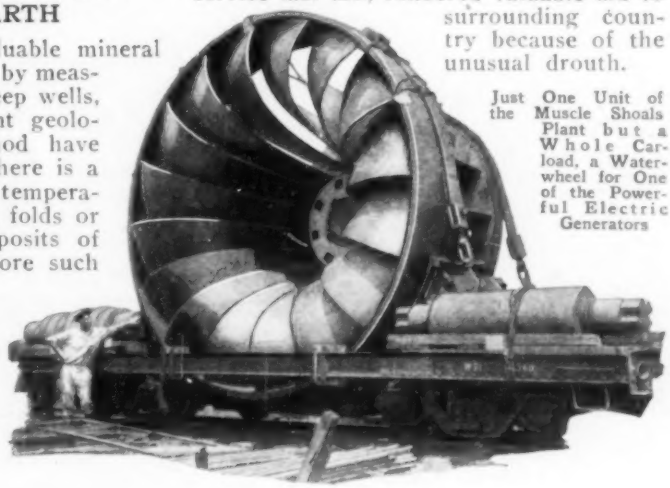
Bungalow on Props and on Rear of Roof of Apartment House Built under It

CLUE TO OIL WELLS SOUGHT IN HEAT OF EARTH

Oil fields and other valuable mineral deposits may be discovered by measurements of the heat in deep wells, according to a government geologist. Tests of the method have shown, he declares, that there is a direct relation between the temperature and the shape of the folds or strata associated with deposits of oil. By taking two or more such measurements, a clue might be gained as to the location of oil-bearing soils in a given area, it is suggested, saving the expense of useless drilling, as small holes large enough for taking the temperatures could be made with diamond drills at much less cost than that involved in boring a well.

BIG TURBINE FOR WILSON DAM OCCUPIES ENTIRE CAR

The magnitude of Muscle Shoals, an engineering dream that is fast becoming a completed reality, is emphasized in such parts of the equipment as the big turbine rotors or water wheels for the generator units at Wilson dam. A single one of these makes a capacity load for a freight car. The rotor is so shaped that water pours into it in radial fashion from all sides, exerting a twisting effect upon the shaft and a final "kick" on the sloping ends of the blades or vanes before it plunges back into the river. A 30,000-horsepower unit of the plant, placed in service last fall, rendered valuable aid to surrounding country because of the unusual drouth.



Just One Unit of the Muscle Shoals Plant but a Whole Carload, a Waterwheel for One of the Powerful Electric Generators

ASBESTOS FIRE-ESCAPE SLIDE OFFERS QUICK EXIT

Demonstrating Use of Asbestos Chute as Means of Escape from Burning Building

Safe and speedy means of exit from a burning building is provided in a canvas-reinforced chute of asbestos. One end is attached to a reel that may be placed near a window or other opening, and the other is held on the ground. The refugee leaps into it and slides quickly to the bottom. The strip is trough-shaped and is strong enough to support heavy weights.

DO APES POSSESS SENSE OF HUMOR?

That chimpanzees have many characteristics like those of human beings has been further established by Prof. Wolfgang Kohler, a German scientist, who spent several years studying the animals in a secluded jungle home on an island off the coast of Africa. He captured nine apes when they were young, gradually tamed them, and then watched their behavior almost daily to see how they would solve problems set for them. One young chimpanzee indicated what appeared to be a sense of humor. While eating its bread ration, fowls gathered and devoured the crumbs. After that, the ape kept out of reach behind the bars and when a hen tried to peck at the bread, the animal pulled it away in apparent glee. If food was placed beyond the cages, the apes learned to "fish" for it with sticks or with crude hooks they devised from straw, grass blades or rags. One tried to use an old straw hat, doubling and redoubling it when the material proved too pliable to serve as a stick. They also learned to pile up boxes and reach for their food when it was suspended from the top of the cage. The apes grew to know and love their keeper, and on one occasion, displayed their gratitude for being let in out of the rain by affectionately patting and embracing him.

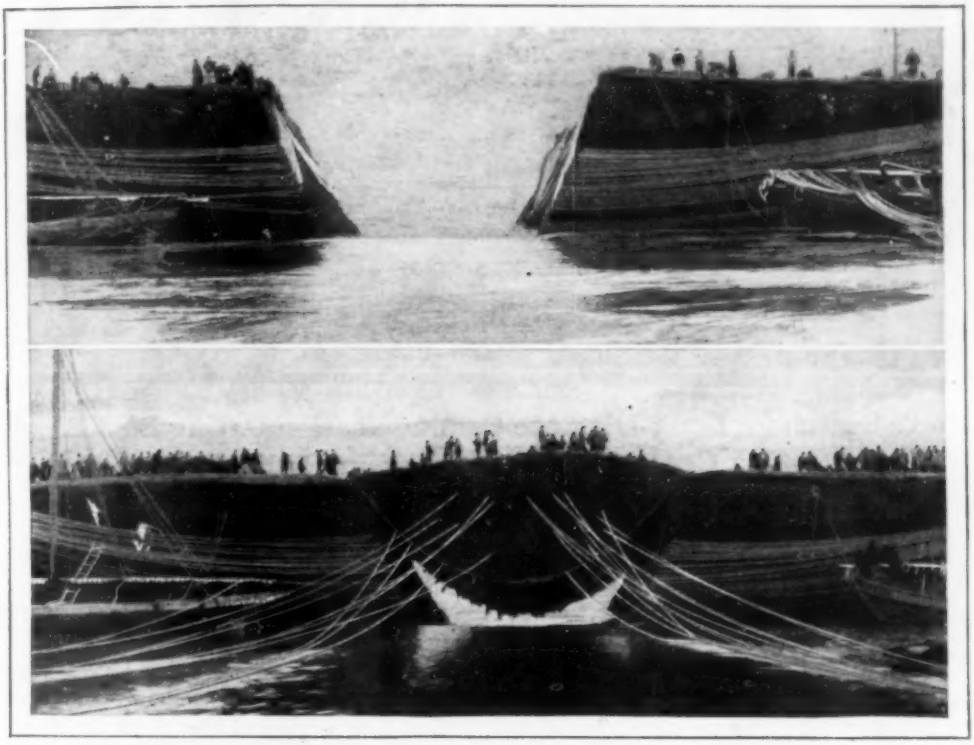
MODEL PLANE IS RUN BY AIR FOR SIXTY SECONDS

Driven by compressed air released against the propeller from a storage tank, a model seaplane constructed by an Englishman, can make a continuous flight of sixty seconds' duration. Air is injected by a hand pump to a pressure of about 180 pounds. The model has a wing span of eight feet, weighs four and one-half pounds and is fitted with floats.

Filling Storage Tank of Air-Driven Model Seaplane

© Henry Miller

DAM BREAKS ARE MENDED WITH EARTH-FILLED NETS



How the Chinese Repair a River Dam; Upper Photograph Shows the Break and Workmen Preparing the Net; Below, the "Plug" Is Settling of Its Own Weight

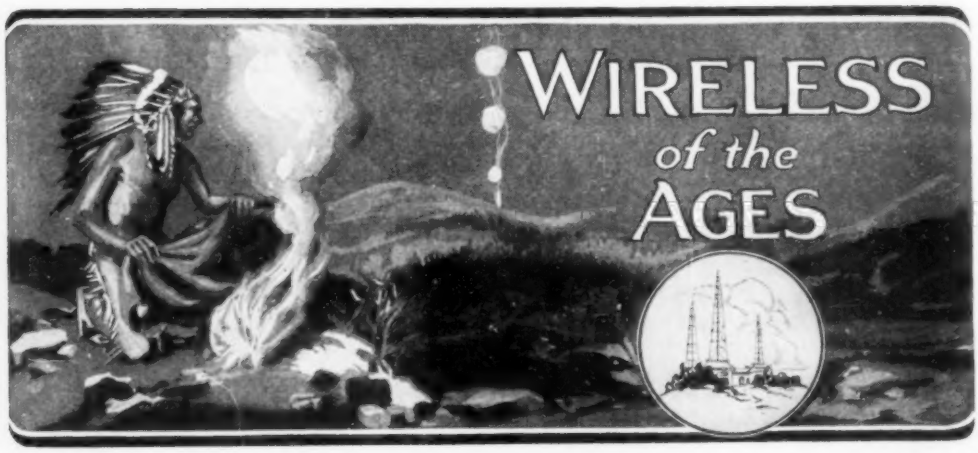
When breaks occur in a dam in China, nets of hempen rope are filled with earth and lowered into the cavity, quickly stopping the leaks. Washouts are not uncommon, and the natives co-operate when repairs are necessary, doing, in a few hours, work that ordinarily would require the attention of skilled engineers.

MYSTERIES OF SKY INCREASED BY STARS THAT GROW COLD

Scientists are able to weigh the sun, moon and stars, and measure the distances of bodies the light from which takes centuries to reach the earth, but the sky is still full of puzzles and one of them is the problem of the dark stars or those that have grown cold and are plunging through space at tremendous rates of speed. In 1901, a blazing star was discovered in the constellation of Perseus. It was not a new body, but probably the result of a collision between two dark stars or the passage of one through a vast cloud of gas or dust, one of the mysterious areas that are found in the heavens. A Dutch scientist, three years ago, found one of these clouds which was 140,000,000,000,000 miles long and twice that distance from the solar system.

BALLOON-TIRE JACK FOR AUTOS GIVES TREAD CLEARANCE

For use in adjusting balloon tires, the screws of an automobile jack are telescoped to give extra clearance needed when raising the car. Since more space is necessary between the rims and the ground for replacing the wider tires than is needed by ordinary treads, the jack is designed with a full extension of seventeen and a half inches.



Man's Search for Long-Distance Communication Dating Back Some Twenty-One Centuries, Has Climax in Radio Newspaper

By J. EARLE MILLER

WITH powerful broadcasting stations sending out the news of the world at half-hour intervals to all who care to tune in, a dream more than twenty-one hundred years old has at last been realized.

The radio service given by American newspapers is the last step in the search for some quick and easy means of communicating intelligence over vast distances to many people, a search that started two hundred years before the Christian era.

Even as late as Civil War days, it took a relay of pony-express riders, galloping at top speed, nine days to bring the news to San Francisco when Fort Sumter was attacked. Today one part of the world can know what the other parts were doing half an hour ago.

Yet with the dream realized there still persists one of man's first wireless systems, so old that its origin is lost in antiquity, but probably antedating any white man's civilization.

With radio messages circling the earth; voice and music being broadcast from continent to continent, and even pictures flashing through 3,000 miles of air, this last of the pre-electric wireless systems—the talking drum—is making its final stand in the heart of Africa, in the jungles of South America, and on the islands of the South Pacific.

In those last outposts of civilization they still roll through the night with their code messages—one of the most efficient "wireless systems" ever developed until Marconi tamed the Hertzian waves.

In the heart of Africa, scores of miles beyond the last white settlement, it is probable that the Wills-Firpo fight of many months ago is still celebrated in song and story, and it is equally probable that the natives knew the outcome within a few hours after the final blow.

When Jeffries was beaten by Johnson in 1910, Thomas Cameron Taylor, a white explorer, was in the heart of the "juju country" in darkest Africa,

SPEEDING THOUGHT

MORE progress in fast communication has been made during the past twenty-five years than in the preceding twenty-five centuries.

Smoke by day and fire by night were first used for transmission of information.

Carrier pigeons have been used for hundreds of years.

Germany equipped the letter carriers with stilts in the sixteenth century to increase their speed.

Among the savage nations, drums are still used to transmit messages over wide areas.

In the United States, stagecoach and pony express furnished the fastest means of communication by letter before the advent of the railroad; but it was not until the invention of the telegraph and later of the telephone and radio that instantaneous communication was established.

The first long-distance message over the telephone was in 1876, from Boston to Cambridge, a distance of two miles. In 1922, the first telephone conversation across the Atlantic ocean took place. In 1924, President Coolidge, sitting in the White House and without raising his voice above an ordinary conversational tone, was heard all over the United States, Canada and parts of Europe

hundreds of miles from the coast and 180 miles from the nearest telegraph line. But within twelve hours after the end of the fight he knew that Johnson had become world's champion. The native drum telegraph was at work.

To a port on the coast, the fight result had come in the summary of the world's news telegraphed by a press association. It was discussed in the presence of the native servants. In a twinkling the news was over the town. In a dirty compound back among the hills behind the settlement a drum begins to beat—a drum fashioned from a hollowed-out log, with a skin stretched across it. Far away a second drum takes up the tale. A neighbor is "listening in." The sender pauses until the first repeater has ceased his re-broadcast, and then takes up the tale again. Bit by bit the story goes on, a long and exultant tale. For hundreds of miles over deep jungles and hidden creeks the rolling drums carry the story.

But the native drum is only the last survivor of more than 2,000 years of wireless experimentation. The Greek runners who carried the news of

Above, Claude Chappe Demonstrating His Clock Semaphore Telegraph in 1791; Semaphore Tower of Napoleon's Army, Center, and the Control Wheel Which Operated the Signal Hands of the Semaphore

wars and battle were one of the first developments. Then came the primitive signal torches—limited in their application because only prearranged intelligence could be transmitted. Polybius, the Greek historian and inventor, records their drawbacks as long ago as 208 B.C. and tells of improvements made by himself and others. Aeneas, the tactician, was the first to add an improvement. He proposed the use of two jars of equal size, fitted with loose cork floats, in which were stuck long reeds marked in narrow rings, with a message written on each ring. Every conceivable message was included. In use, the sender signaled with a torch to the distant receiving station, where a second torch acknowledged the fact that the listener was "standing by." Both then opened taps in the bottoms of their jars and let the water flow out until the sender raised his torch as a signal that the ring with the proper message had just descended to the top level of the jar. The taps were then closed and the message read, after which the jars were refilled with water. The system, however, was imperfect. Word that an army had attacked or a fleet arrived could be telegraphed, but the message could not tell

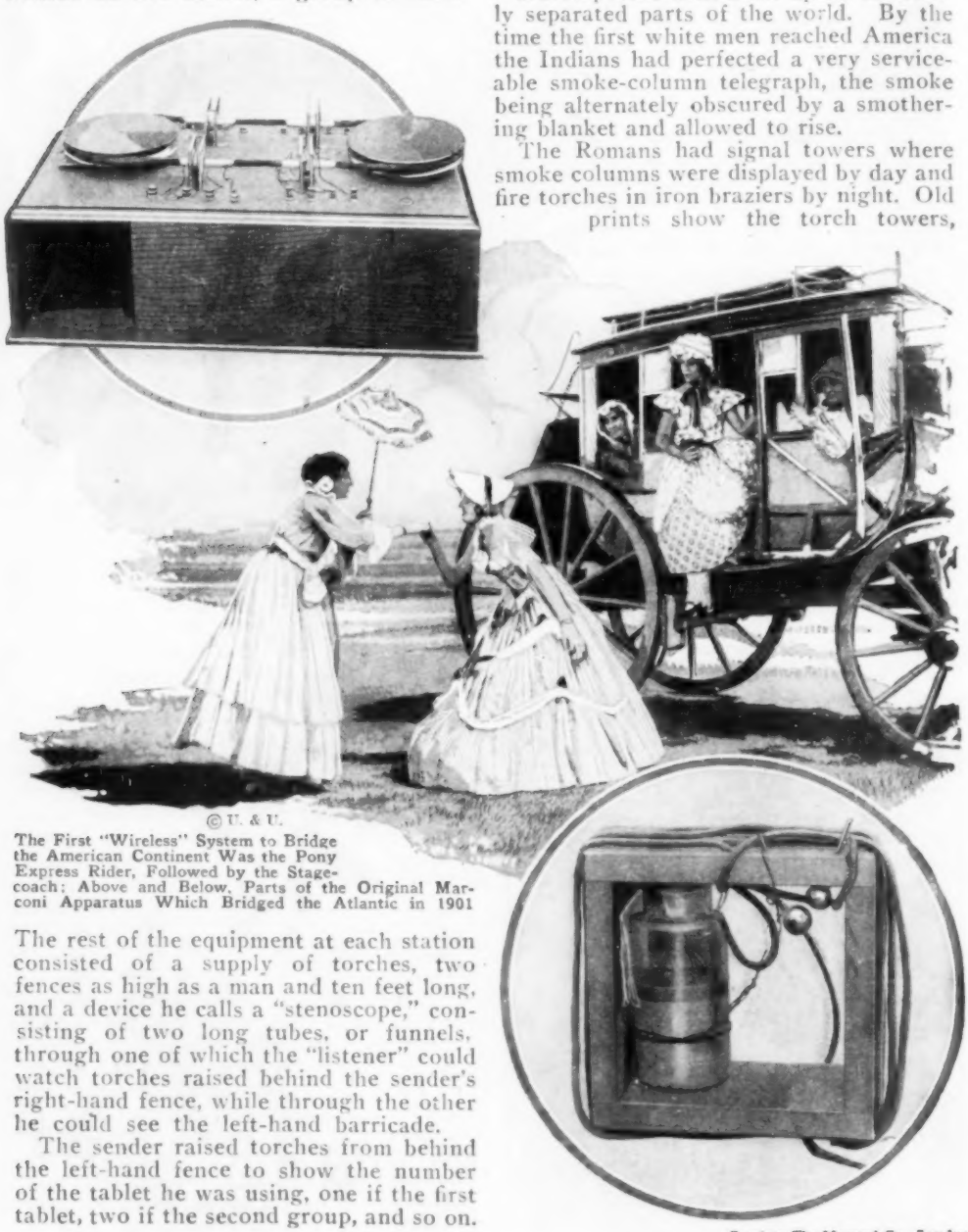
how many men were in the army or the number of vessels in the fleet.

Cleoxenus and Democlitus tried to improve on Aeneas' system, and Polybius himself finally brought it to what he claimed was perfection. He divided the Greek alphabet into four groups of five letters and one of four letters. The sending and receiving stations had the groups written on five tablets, a group to each. He then raised torches behind the right-hand barricade to show the number of the letter on that tablet, and thus slowly spelled out his message.

The Greeks tried various improvements on the Polybius system, but all were far from satisfactory because of the limitations of distance and also the lack of speed in transmitting.

Development continued apace in widely separated parts of the world. By the time the first white men reached America the Indians had perfected a very serviceable smoke-column telegraph, the smoke being alternately obscured by a smothering blanket and allowed to rise.

The Romans had signal towers where smoke columns were displayed by day and fire torches in iron braziers by night. Old prints show the torch towers,



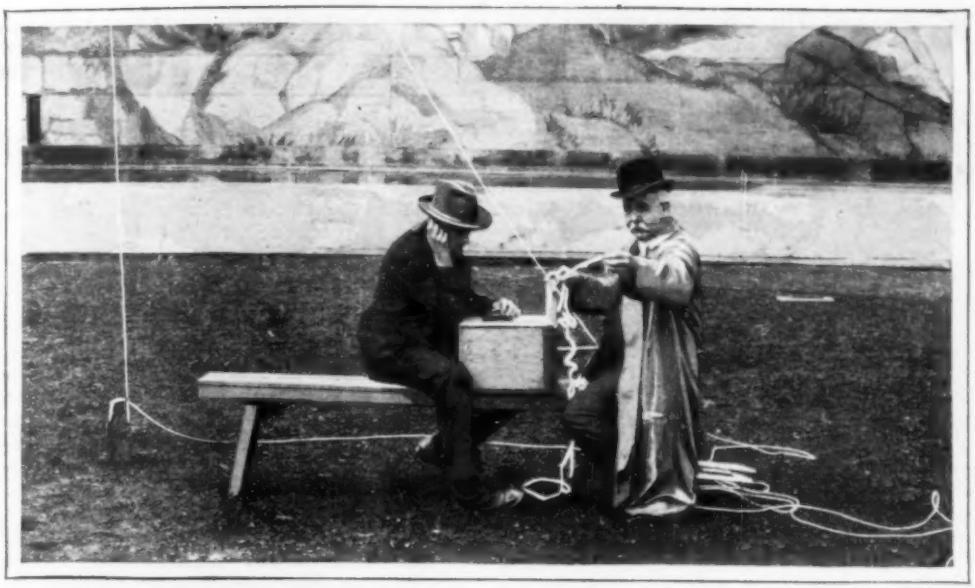
© U. & U.

The First "Wireless" System to Bridge the American Continent Was the Pony Express Rider, Followed by the Stagecoach; Above and Below, Parts of the Original Marconi Apparatus Which Bridged the Atlantic in 1901

The rest of the equipment at each station consisted of a supply of torches, two fences as high as a man and ten feet long, and a device he calls a "stenoscope," consisting of two long tubes, or funnels, through one of which the "listener" could watch torches raised behind the sender's right-hand fence, while through the other he could see the left-hand barricade.

The sender raised torches from behind the left-hand fence to show the number of the tablet he was using, one if the first tablet, two if the second group, and so on.

Courtesy The Marconi Co., London



Courtesy The Marconi Co., London

Against a Painted Background of Newfoundland Scenery, G. S. Kemp, at Right, Marconi's Assistant in the Historic 1901 Experiment, Reconstructs the Original Apparatus at Wembley Exposition

strongly fortified and protected by wicker fences, behind which fierce dogs prowled to give warning of the attack.

France came to the front with a semaphore system, the two arms being controlled by ropes and wheels inside a tower. A French inventor, Claude Chappe, in 1791, produced an "aerial telegraph" which worked over a distance of nine and one-half miles. A dial like a clock, with letters instead of figures, had a single revolving hand, worked by rods and gears. The dial was painted white and the figures and hand were black, so they could be seen at great distances. It is noteworthy that Chappe proposed to operate the dials by electricity, with a system of condensers between the stations, but was never able to make his dream work. While France in the Middle Ages already was experimenting with semaphore systems, England had beacon fires on every hilltop. Drake got word of the coming of the Spanish Armada in this way, and the news was flashed entirely around England and Scotland. With the development of better cannon, noise displaced smoke and fire, and signal guns grew common. Up to that time the "wireless" had been used principally for war purposes, to warn of attack and report victory or defeat, but later it gradually was applied to peaceful pursuits. The curfew bell and the morning and evening signal gun, telling of sunrise and sunset,

The African Wireless, a Ceremonial Drummer at the Court of the King of Ugandi

still survive. The electrical telegraph got its first war tryout in the Franco-Prussian and Crimean wars. It was not "wireless," but it did get messages across long distances, provided the enemy or a chance shell did not break the wire circuit.

The wire telegraph never quite displaced other "wireless" systems, since it always had the drawback of needing wires, which took time to erect, and were always subject to interruption. The heliograph, a system of sun flashing, remained in use with armies until the World War, and semaphore flags and blinker lights are still used by the world's navies.

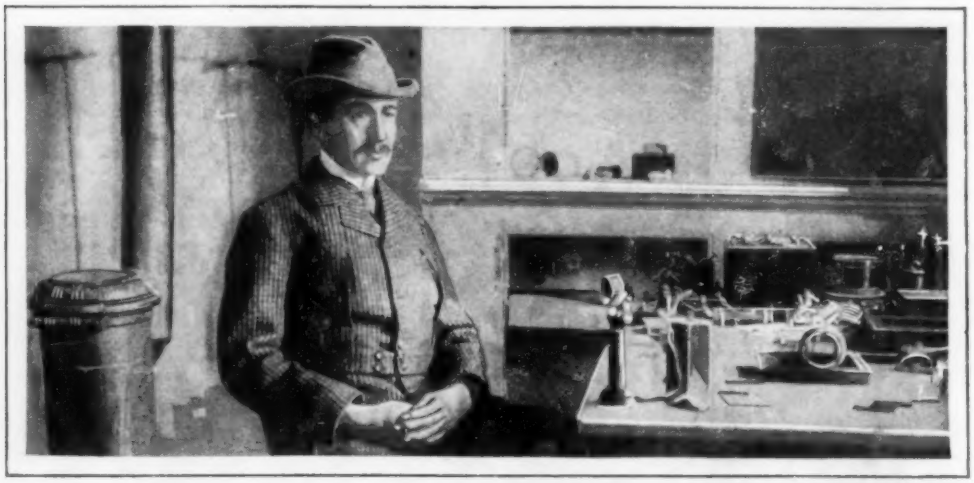
The heliograph was a true "wireless" system, with the drawback that its operation was confined to days when the sun shone. Two adjustable mirrors, mounted on a crossarm fastened to a tripod, were used, the one to reflect the sun's rays on the other, which was aimed in the direction in which the signal was to be sent. Before this mirror another tripod, bearing a shutter operated by a lever, was placed. The lever could be worked like an ordinary telegraph key, sending messages in Morse code by passing dots and dashes of sunlight. In the clear air of the southwest, the system has been used over distances of more than seventy miles.

The pre-electric wireless of ships at sea included not only the international code flags, but semaphore flags which could be used in code combinations corresponding to the telegraph code. At night electric blinker lights on the yard arms of warships flash out Morse code messages to other vessels of the fleet.

But wherever civilization has touched, the wireless, and particularly the new short-wave apparatus, is replacing the older systems.

ELEPHANTS USED AS TEACHERS TO TRAIN OTHERS TO WORK

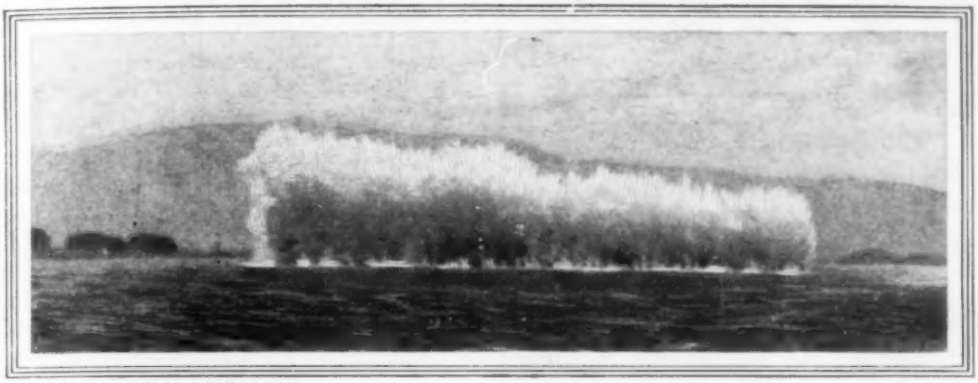
Imported Indian elephants are employed as teachers for their African cousins in a training school for the latter at Api in the Belgian Congo. In the earlier days of the school, which was founded about twenty-five years ago, grown-up animals were taken as pupils, but they were dangerous, difficult to catch and resisted the efforts of the human instructors who sought to train them for useful work. The method now in vogue is to capture the elephants when young and give them educated Indian beasts as individual teachers. Each new scholar is tied by a rope to the leg of its mentor and, willing or not, must follow. In a short time, the pupil learns, by example, how to pull a cart, roll tree trunks and carry burdens. The camp at Api now has forty-two African elephants in training. They not only pay for their schooling by their work but become as good teachers as the Indian animals. The African buffalo is also being trained successfully, and a second school is to be established in the same neighborhood. It is known that the ancient Romans and Carthaginians used to train elephants in warfare, hence it is believed that they must have known how to tame them, but the method seems to have been forgotten for some 2,000 years.



Courtesy The Marconi Co., London

Senator Marconi Sitting before His Instruments in the Cabin on a Newfoundland Hilltop Where He First Heard the Letter "S" Sent through the Ether from His English Broadcasting Station

DYNAMITE LAKE BOTTOM TO INSURE WATER SUPPLY



Courtesy the Explosives Engineer

Taken an Instant After the Charge Was Fired, Tons of Water and Dirt Thrown into Air as 400 Pounds of Dynamite Were Exploded to Deepen Lake Channel

Four hundred pounds of dynamite were used effectively near Salt Lake City, Utah, to deepen a lake channel leading to a pumping plant that supplies irrigation ditches and copper mills near by. The shots were placed under the water in two rows of holes, forty inches apart and about two and one-half feet deep at intervals of eighteen inches. All the sticks were fired simultaneously by electricity. Soundings showed that the blast had cleared a passage about five feet deep and twelve feet wide. The water was from a foot and a half to two feet deep.

VOLCANOES SILENT FOR AGES NOT ALL DEAD

Although the snow-capped volcanic cones on the Pacific coast long have been inactive, not all of them are regarded as scientifically "dead," and some scholars believe that further eruptions from these "sleeping volcanoes" are not impossible. In the northwest, Mount Rainier and Mount Baker, in Washington, and Mount Hood, in Oregon, with Mount Shasta and Lassen peak farther south in California, form a chain of peaks all of which, it is believed, were once in violent eruption. Since 1914, Mount Lassen has been the scene of minor disturbances, and during the past century, there have been several small eruptions from Mount Rainier.

TILE DESIGNS ON CEMENT TUBS BRIGHTEN PLANT DISPLAY

Patterns in polished, colored tiles have been worked into cement tubs for holding shrubbery by a western firm. The decorations relieve the drab concrete and since the tiles are of scrap and left-over pieces, practically no added expense is involved, save that of arranging the designs. The tubs are heavy and have wide, flat bottoms.

Plant Tubs of Cement, Made Attractive by Tile Designs

Sensitive Tube to Help Radio Movies; It Emits Electric Impulses When Light Strikes It

RADIO TUBE IS SO SENSITIVE A SHADOW HOWLS

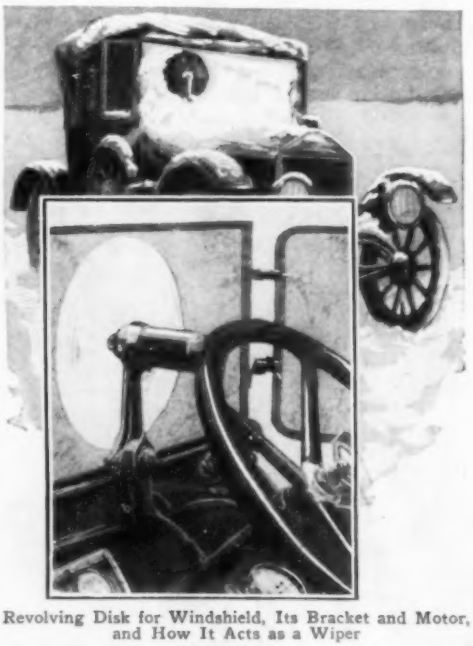
Successful transmission of motion pictures by radio over distances far greater than have been attempted in experiments up to the present time, is promised in the development of a new photo-electric tube, one of the most sensitive units known to science. It sends out electric currents and radio impulses when light falls upon it. Already, its properties have been used in steering ships, controlling railroad trains automatically and recording light from the stars.

MYSTERY SEEN IN MONUMENTS MANY CENTURIES OLD

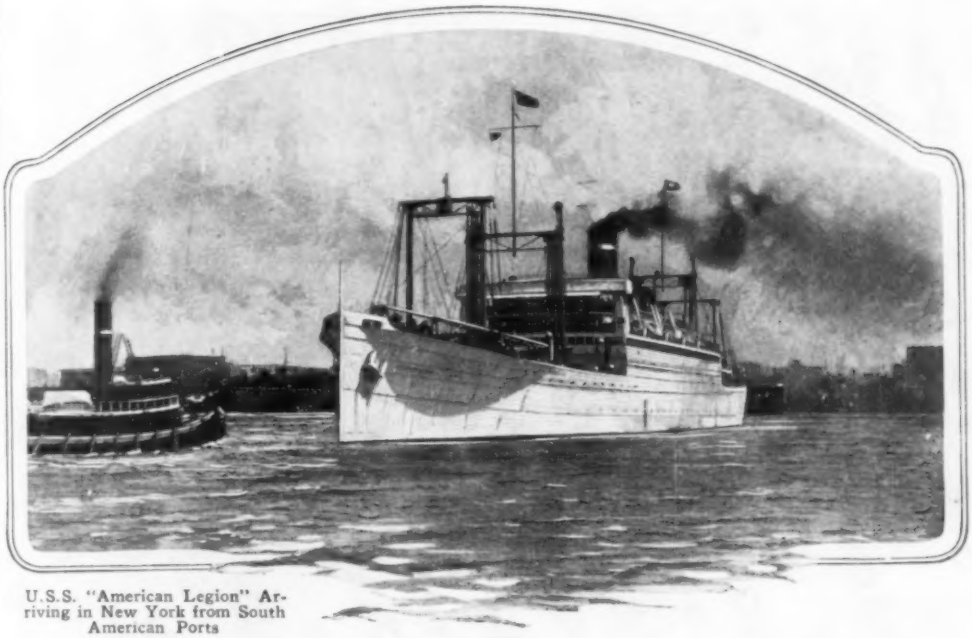
Lake dwellers in Switzerland, 10,000 years ago, built their houses on piles just as the seashore cottager in America does today, recent explorations have disclosed. The supports were discovered at Lake Neuchatel, extending slightly above the water which had preserved the wooden columns from decay. Stone hearths and pots, in which were cherry pits and strawberry seeds, were found on the lake bottom near the piles. Bits of fish netting, materials used for clothing and ruins of a canoe or light skiff, shed additional light on the picture of a lake dweller's life as it was lived about a hundred centuries ago. Records of an earlier civilization were found in southern France in the form of crude weapons and instruments possibly belonging to a period 100,000 years ago. In Brittany, monuments like those of the Druids at Stonehenge, present a mystery. They are from 50,000 to 100,000 years old and while some of them are tombstones, the majority are not, their true significance being a matter of conjecture. Another prehistoric mystery is seen in the famous cave at Altamira, in Spain. It contains one of the finest art galleries of primitive man and was hidden for centuries until a little girl playing in the cave, saw the queer carvings and called her father. Years later, scientists vouched for their genuineness. The men who carved the figures must have had artificial light, they were highly skilled but gave evidence of ancient superstitions, in that they omitted the human body in their designs, using only the likenesses of animals.

ROTATING DISK ON WINDSHIELD REPLACES WIPER

As a substitute for the squeegee type of windshield wiper, a motor-driven glass disk that throws off mist and rain permits uninterrupted vision, is silent and requires but little current. It may be placed either in front or behind the windshield, and is mounted on a ball-bearing shaft which is supported by an aluminum bracket carrying the motor. The screen whirls rapidly, and has the additional advantage that it leaves no streaks. It has been used successfully on the bridges of large ocean liners to permit taking bearings in stormy weather.



Revolving Disk for Windshield, Its Bracket and Motor, and How It Acts as a Wiper



U.S.S. "American Legion" Arriving in New York from South American Ports

South America New Winter Playground

U. S. Liners and Panama Canal Make Continent Mecca for Tourists and Draw American Capital for Development

LURED by summer weather when it is winter in the northern hemisphere, Americans are turning to South America both as a tourist resort and to invest capital in the development of the vast potential resources of that continent. With four government-owned liners, operated by a private company for the United States shipping board, serving the east coast, and the Panama canal bringing the west coast days nearer New York, South American travel has been made as comfortable as going to Europe.

There has always been a close bond of sympathy between the two continents. Simon Bolivar, the liberator of Peru, Ecuador, Bolivia, Colombia and Venezuela, formed his ideas of republican government on a visit to the United States, and after he had driven the Spanish out, the Monroe doctrine made South American independence certain.

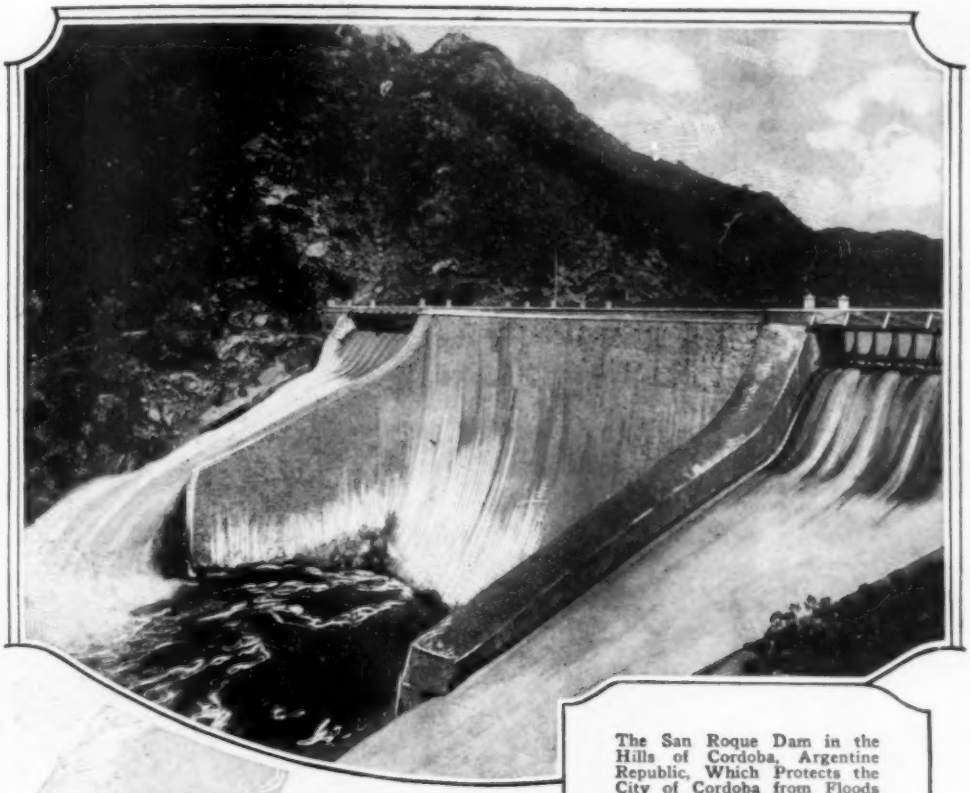
Accustomed to think of the frequently revolution-torn republics of Latin America as unimportant nations, most Americans underestimate their size and potentialities. Colombia and Venezuela, the nearest to the United States, are no farther from Florida than Kansas City is from New York, and the first covers as much territory as Texas, California and New York combined, while the second could swallow all of France and Germany. Yet with extraordinary resources of timber, petroleum, metals and agricultural lands, they still are in the infancy of economic development.

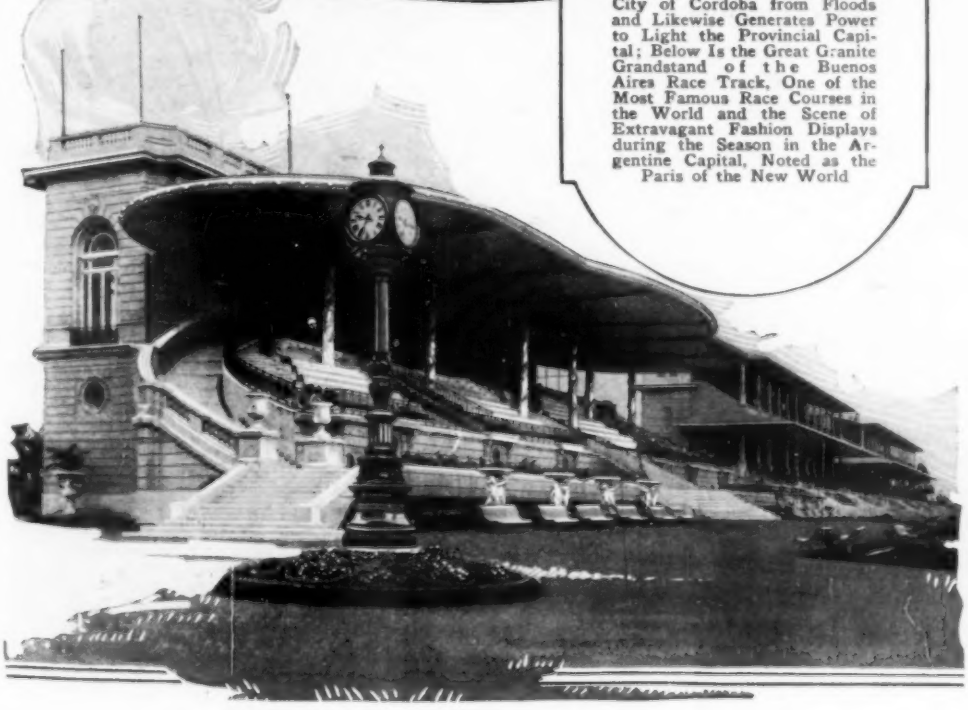
Brazil, which occupies just half of South America, is as big as the continental United States, Spain and Italy combined, while Argentina, if set down on North America, would cover all the states east of the Mississippi and part of the first tier west of the river. Chile, on the west coast, is almost as big as California, Oregon and Washington, and Bolivia and Peru are twice as large.

The Panama canal and the fast service of the government ship lines have made it possible to reach Rio de Janeiro in eleven days from New York, go on to Santos, the coffee capital of the world, Montevideo, and Buenos Aires, the Paris of South America, cross the Andes by one of the world's highest railroads, visit Santiago and Valparaiso, sail up the west coast to Antofagasta, Iquique, Arica, Callao, Lima, visiting the ancient Inca ruins on the way, then on to the canal, through it, and back to New York.

Photos Courtesy of Pan-American, Line and Pan-American Union

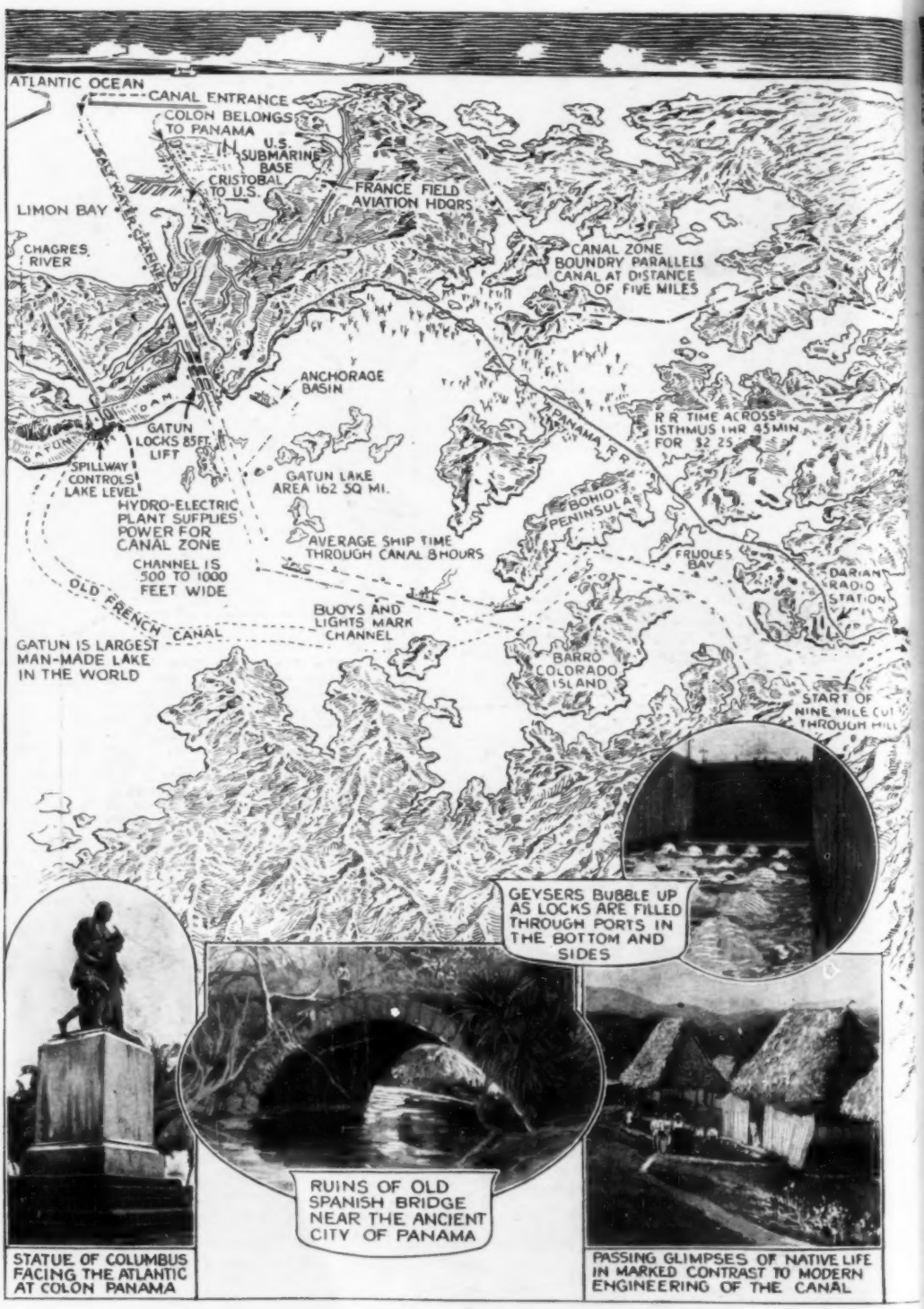
The Magnificent Crescent Harbor of Rio de Janeiro, Above, Dotted with Island Peaks and the Famous Sugar Loaf Mountain in the Background; at Right, the Tomb of Simon Bolivar, "El Libertador" in the Panteon Nacional at Caracas, Venezuela; Bolivar, Who Created More Free Countries Than Any Man in History, Drove the Spaniards from What Is Now Colombia, Bolivia, Ecuador, Peru and Venezuela, and Was at One Time President of Colombia, President for Life of Peru and "Perpetual Protector" of Bolivia, Which Had Been Named in His Honor and Whose Constitution He Wrote; He Obtained His Idea for Freeing His Native Land on a Visit to the United States



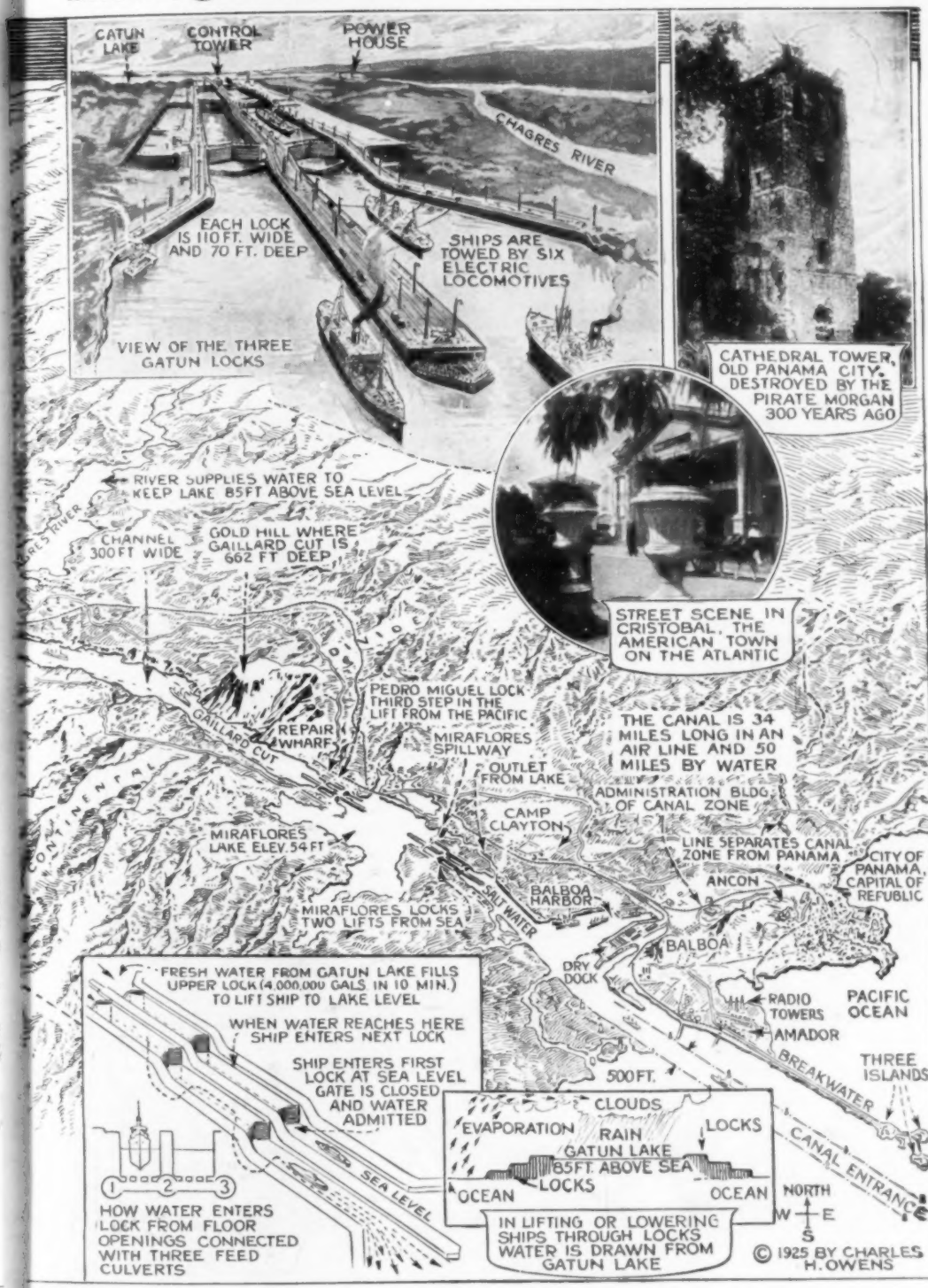


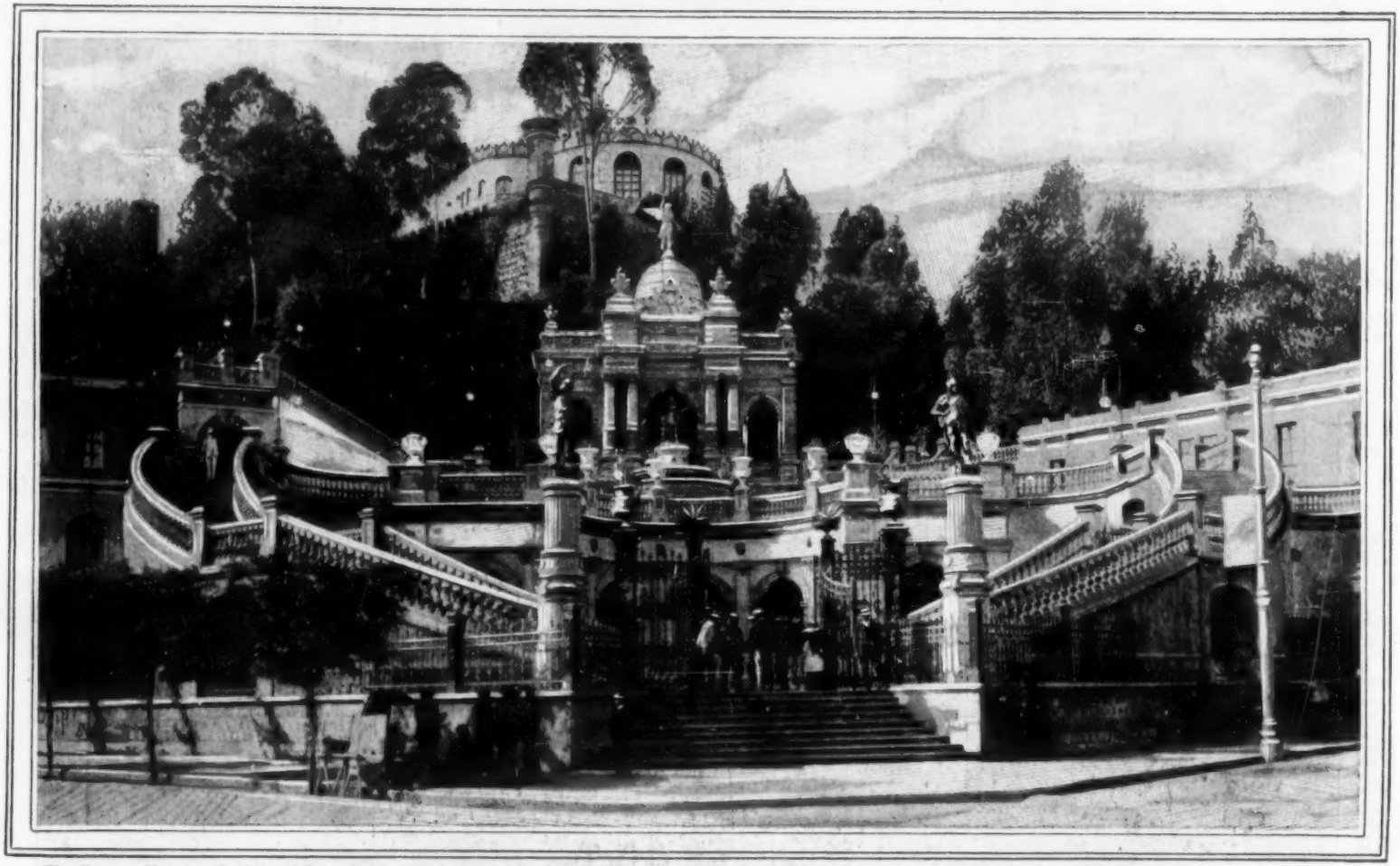
The San Roque Dam in the Hills of Cordoba, Argentine Republic, Which Protects the City of Cordoba from Floods and Likewise Generates Power to Light the Provincial Capital; Below Is the Great Granite Grandstand of the Buenos Aires Race Track, One of the Most Famous Race Courses in the World and the Scene of Extravagant Fashion Displays during the Season in the Argentine Capital, Noted as the Paris of the New World

Bird's-Eye View of Panama Canal Zone


ATLANTIC OCEAN
CANAL ENTRANCE
COLON BELONGS TO PANAMA
U.S. SUBMARINE BASE
CRISTOBAL TO U.S.
FRANCE FIELD AVIATION HDQRS
LIMON BAY
CHAGRES RIVER
CANAL ZONE BOUNDRY PARALLELS CANAL AT DISTANCE OF FIVE MILES
ANCHORAGE BASIN
GATUN DAM
GATUN LOCKS 85 FT. LIFT
SPILLWAY CONTROLS LAKE LEVEL
GATUN LAKE AREA 162 SQ MI.
PANAMA R R
R R TIME ACROSS ISTHMUS 1 HR 45 MIN FOR $2.25
BOHIO PENINSULA
HYDRO-ELECTRIC PLANT SUPPLIES POWER FOR CANAL ZONE
AVERAGE SHIP TIME THROUGH CANAL 8 HOURS
FRIJOLES BAY
DARIAN RADIO STATION
CHANNEL IS 500 TO 1000 FEET WIDE
OLD FRENCH CANAL
BUOYS AND LIGHTS MARK CHANNEL
GATUN IS LARGEST MAN-MADE LAKE IN THE WORLD
BARRO COLORADO ISLAND
START OF NINE MILE CUT THROUGH HILL
GEYSERS BUBBLE UP AS LOCKS ARE FILLED THROUGH PORTS IN THE BOTTOM AND SIDES
RUINS OF OLD SPANISH BRIDGE NEAR THE ANCIENT CITY OF PANAMA
STATUE OF COLUMBUS FACING THE ATLANTIC AT COLON PANAMA
PASSING GLIMPSES OF NATIVE LIFE IN MARKED CONTRAST TO MODERN ENGINEERING OF THE CANAL

Showing Locks and Points of Interest

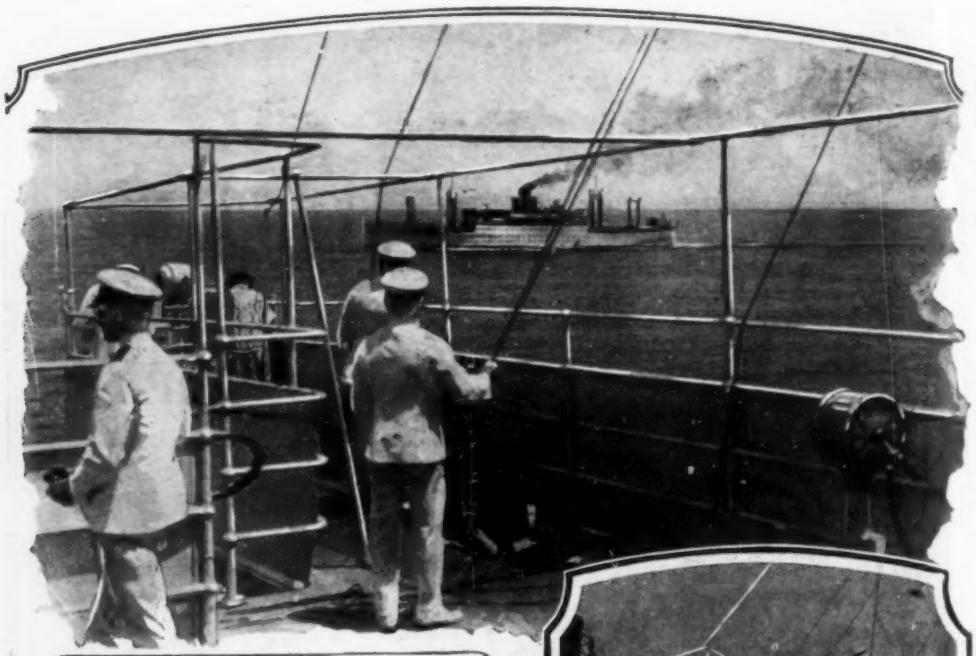

GATUN LAKE
CONTROL TOWER
POWER HOUSE
CHAGRES RIVER
EACH LOCK IS 110 FT. WIDE AND 70 FT. DEEP
SHIPS ARE TOWED BY SIX ELECTRIC LOCOMOTIVES
VIEW OF THE THREE GATUN LOCKS
CATHEDRAL TOWER, OLD PANAMA CITY, DESTROYED BY THE PIRATE MORGAN 300 YEARS AGO
STREET SCENE IN CRISTOBAL, THE AMERICAN TOWN ON THE ATLANTIC
RIVER SUPPLIES WATER TO KEEP LAKE 85 FT ABOVE SEA LEVEL
CHANNEL 300 FT WIDE
GOLD HILL WHERE GAILLARD CUT IS 662 FT DEEP
GAILLARD CUT
REPAIR WHARF
PEDRO MIGUEL LOCK THIRD STEP IN THE LIFT FROM THE PACIFIC
MIRAFLORES SPILLWAY
OUTLET FROM LAKE
THE CANAL IS 34 MILES LONG IN AN AIR LINE AND 50 MILES BY WATER
ADMINISTRATION BLDG. OF CANAL ZONE
CAMP CLAYTON
LINE SEPARATES CANAL ZONE FROM PANAMA
CITY OF PANAMA, CAPITAL OF REPUBLIC
ANCON
MIRAFLORES LAKE ELEV. 54 FT
BALBOA HARBOR
SALT WATER
MIRAFLORES LOCKS TWO LIFTS FROM SEA
BALBOA
DRY DOCK
RADIO TOWERS
PACIFIC OCEAN
AMADOR
THREE ISLANDS
500 FT.
BREAKWATER
CANAL ENTRANCE
FRESH WATER FROM GATUN LAKE FILLS UPPER LOCK (4,000,000 GALS IN 10 MIN.) TO LIFT SHIP TO LAKE LEVEL
WHEN WATER REACHES HERE SHIP ENTERS NEXT LOCK
SHIP ENTERS FIRST LOCK AT SEA LEVEL GATE IS CLOSED AND WATER ADMITTED
SEA LEVEL
1 2 3
HOW WATER ENTERS LOCK FROM FLOOR OPENINGS CONNECTED WITH THREE FEED CULVERTS
CLOUDS
EVAPORATION
RAIN
LOCKS
GATUN LAKE
85 FT. ABOVE SEA
LOCKS
OCEAN
OCEAN
IN LIFTING OR LOWERING SHIPS THROUGH LOCKS WATER IS DRAWN FROM GATUN LAKE
NORTH
W E
S
© 1925 BY CHARLES H. OWENS



The Famous Hanging Gardens of Santa Lucia Hill Is One of the Noted Show Spots in Santiago, Chile; the Cities of Latin America Are Filled with Magnificent Public Buildings, Statues and Parks, Showing the Effect of Spanish, Italian and French Influences

Every Trave'er Crossing the Equator for the First Time Is Called before the Court of King Neptune and Initiated into the Ancient Order of "Freemen of the Seas"; the Sailors Are Lathered with Flour Paste, Shaved with a Wooden Razor and Then Dumped into a Water Tank, but the Passengers Are More Leniently Treated; Even Sand Piles for the Little Tots Are Provided on the Government Owned Ships

The Famous Hanging Gardens of Santa Lucia Hill Is One of the Noted Show Spots in Santiago, Chile; the Cities of Latin America Are Filled with Magnificent Public Buildings, Statues and Parks, Showing the Effect of Spanish, Italian and French Influences

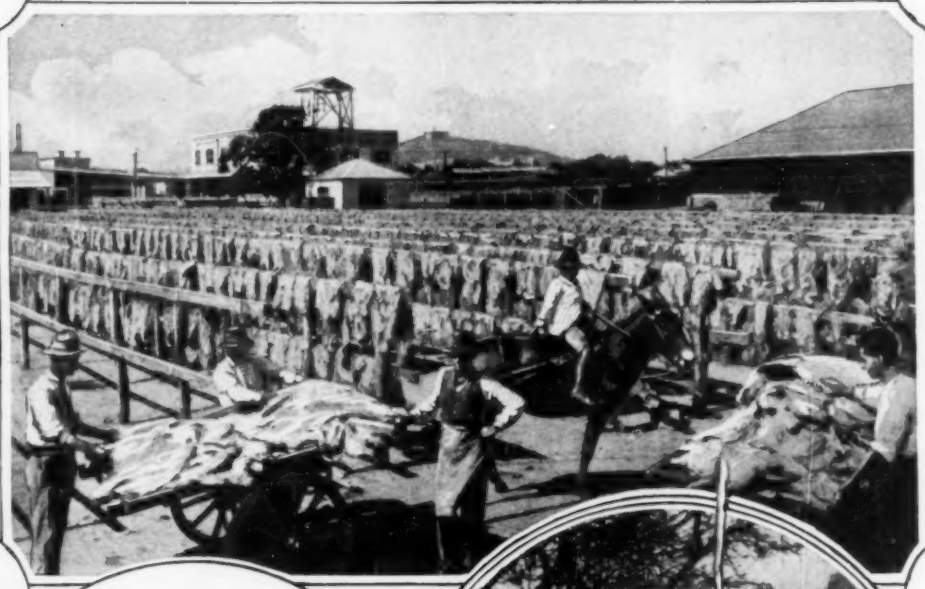


Two of the Shipping-Board Liners Passing near the Equator, Above, and a Cargo of Coffee Being Taken on Board the S.S. "Southern Cross," Plying between New York and the East-Coast Ports of South America

Statue of Simon Bolivar at Caracas, Venezuela; Similar Honor Has Been Paid the Liberator of Five South American Countries by Erecting a Statue of Him in Central Park, New York City

Homes Clinging to the Hills Overlooking the Fishing Boats Drawn Up on the Sands at Old Panama City; at Right, Trans-Andean Train Climbing the Argentine Side of the Range, Bound for the Pacific Slopes

The "Casa Rosada," or Pink House Which Is the Home of the Argentine President

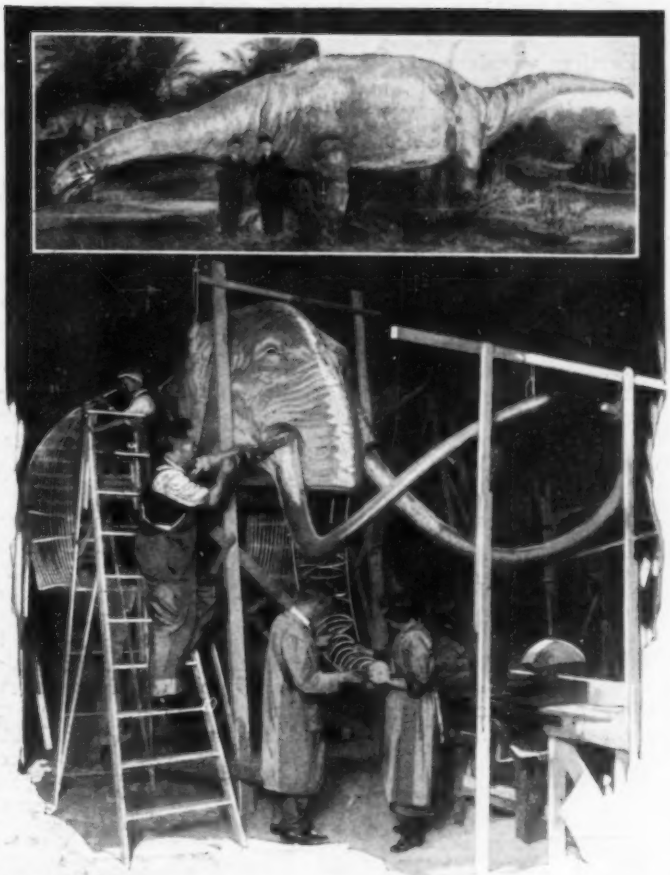


Jerked Beef Is Prepared and Hides Dried on Open-Air Racks under the Sun in Montevideo, Uruguay; Above Is One of the Large Plants from Which Meat and Hides Are Shipped to All Parts of the World; at Right, an Indian Family in El Gran Chaco, Tropical Territory in Northern Argentina

One of the Huge Meat-Packing Plants in Uruguay; Both Native and American Companies Operate in South America

ANCIENT MONSTER LIVES AGAIN IN MOVING MODEL

Equipped with a system of gears operated by motors, a huge moving model of a brontosaurus, a reptile that, scientists say, roamed this continent 10,000,000 years ago, has been built for the American Museum of Natural History in New York City. It is nearly forty-nine feet long and weighs two tons. The body is nine feet high, the head is sixteen feet above the ground when up and the tail fifteen. Both touch the ground when lowered. The neck has five different motions, each leg four, the head three, the tail four and the stomach three. These are obtained by means of speed-reduction gears run by ten motors installed on a table inside the model and controlled from one switchboard, and the motions may be reversed if desired. The body is of rattan, put together with springs to give flexibility. The head and neck are controlled by heavy steel tubing operated through a series of gears and flexible shafts. The covering required 150 yards of heavy quilting with a composition worked over it. The head and feet are made of papier-mache, and the coloring of the animal is executed in green, brown and gray. The monster is modeled after the skeleton of one found in Wyoming some years ago.



Upper Photo Shows the Completed Model of the Brontosaurus; Below, Workers Are Constructing Flexible Framework for Replica of Mammoth

TEST TO GAUGE SPEED OF LIGHT WITHIN FINAL MILE

By reflecting beams between two specially constructed mirrors 100 miles apart, Prof. Albert A. Michelson of the University of Chicago, hopes to measure the speed of light to within at least five miles or perhaps even one mile of its actual rate. His tests already have shown that its approximate velocity is 186,300 miles a second. These data were gathered by projecting a powerful light through a mirror which was spinning at the rate of about 30,000 revolutions a minute, to a reflecting apparatus twenty-two miles away. The experiments were conducted between Mount Wilson and Mount San Antonio in California. The further tests, planned for this summer, are to be done with more refined instruments. The revolving mirror to be used will have a capacity of three times that of the former. The present estimate of the speed of light is believed to be correct within twenty miles. One of the practical uses of an accurate figure for the velocity is in measuring the distances between points. Knowing the speed of light, it is possible to figure distances with an error of less than one part in a million, an accuracy which no engineering instrument can attain.

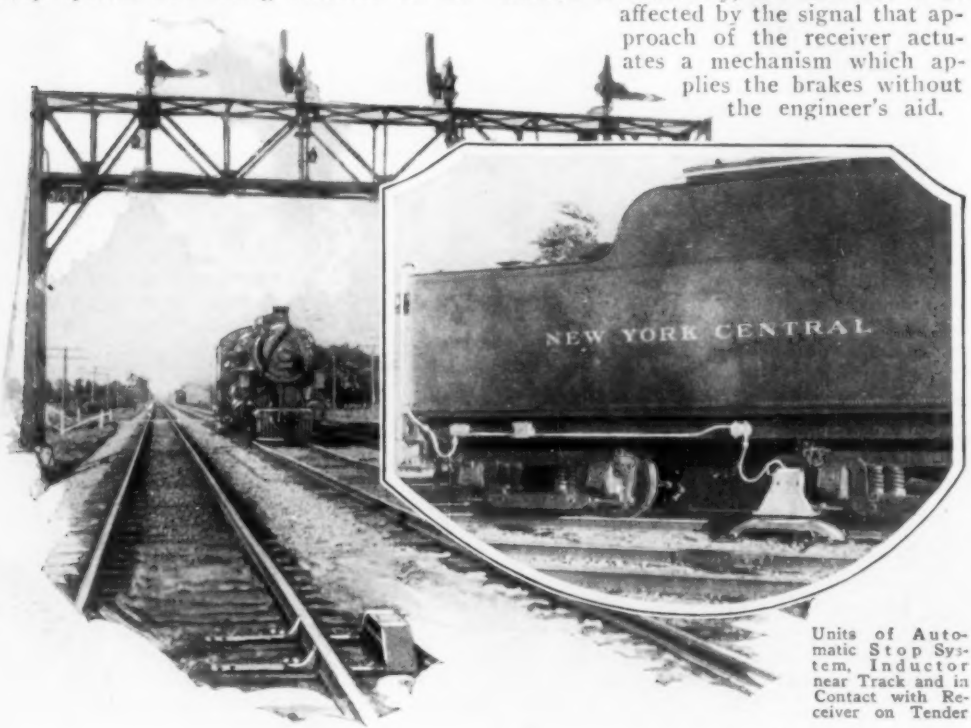
¶Our Bureau of Information will answer all questions regarding articles appearing in this magazine.

STADIUM REVEALS SECRETS OF ANCIENT RACE

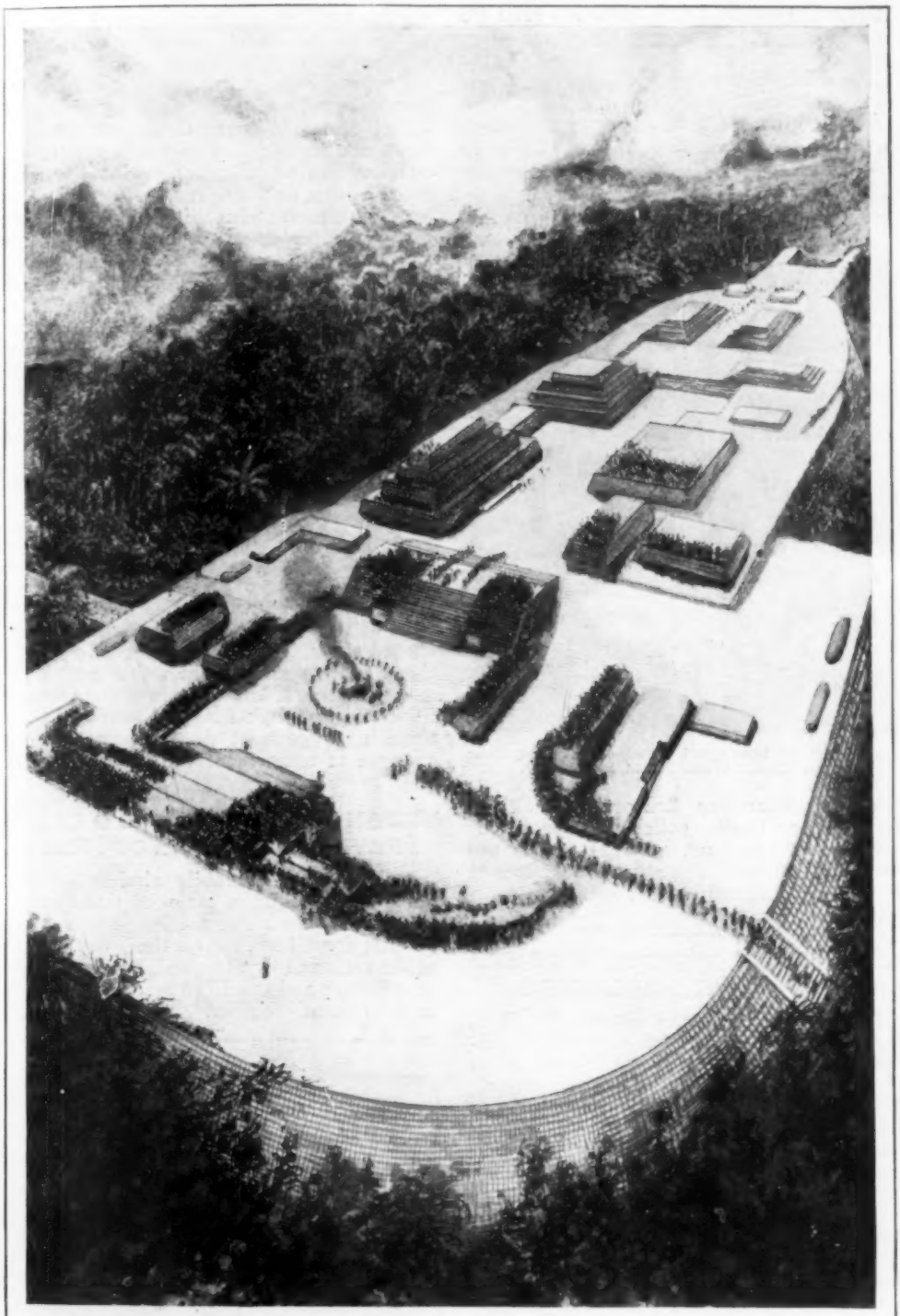
Further wonders of the ancient Maya civilization in Central America have been disclosed by the excavation of a stone citadel, occupying nearly eight acres at Lubaandum in southwestern British Honduras. It is pear-shaped, nearly fifty feet high, and its summit is covered by great terraced pyramids and cement-floored plazas. The northern half of the structure is devoted to an amphitheater, where, it is believed, allegorical dramas were presented to the accompaniment of weird music for the entertainment of as many as 10,000 persons at one time. Banks of seats, similar to those of a stadium, commanded a full view of the central court. The pyramids are flat-topped, unlike those found in other Maya ruins, and show no signs of ever having supported temples or palaces, giving further indication that the citadel was devoted to a special purpose. Graves were discovered on some of the elevations, containing relics similar to those unearthed in burial places outside the stadium, and the bones, in no case, indicated an age of more than three or four centuries while, in some instances, the burials had occurred less than 100 years ago. Objects found included spears and javelin heads of flint, ax heads, hammers, beads, mirrors of iron, pottery, grinding stones, shell trumpets and whistles. Near the surface of one of the diggings, a figurine showing a man in medieval European dress was picked up, indicating that the manufacture of these articles must have continued after the Spanish conquest, when the Mayas were driven into the forests, killed or forced into slavery by their captors.

ELECTRIC TRAIN-STOP SYSTEM TO PREVENT COLLISIONS

Air brakes are applied automatically and the locomotive must be halted before they can be released by an electric train-stop system now being installed on an eastern railroad. It consists, roughly, of two main units, an inductor, set in the roadbed close to the track and connected to the block-signal system, and a receiver which is attached to the locomotive tender. In case the block is obstructed or caution is necessary, the inductor is so affected by the signal that approach of the receiver actuates a mechanism which applies the brakes without the engineer's aid.



Units of Automatic Stop System, Inductor near Track and in Contact with Receiver on Tender

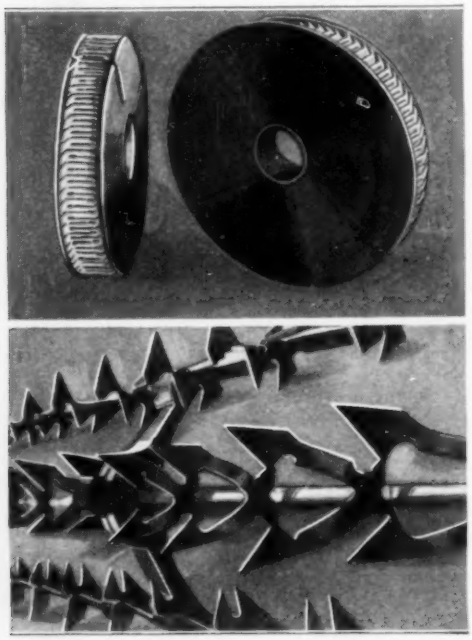


Courtesy Illustrated London News

Largest Prehistoric Building on the American Continent, a Reconstruction Drawing of a Ceremony in a Maya Citadel, the Remains of Which Have Been Cleared from Forest in British Honduras

BARBED BAND ON SPOOL HELPS TO PROTECT GARDEN

As a substitute for barbed wire, bands of metal bristling with points are tacked to the top of rails or between the fence



Bands Flat on Spools and Unwound, Showing How Barbs Extend When Strand Is Stretched

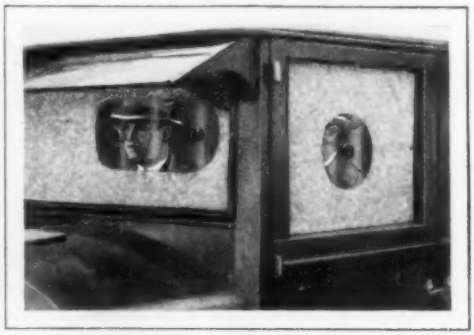
posts to protect the yard or garden. The lengths are neatly coiled on spools for convenient handling, and the points are not exposed until the strand is stretched out. The material weighs less than ordinary wire.

ATTRACTION OF MOON WEIGHED IN DELICATE BALANCES

Sensitive balances devised by Prof. Ralph C. Hartsough of Columbia university are so delicate that they will react to one 280-billionth part of an ounce. They register the effect produced in a fraction of a second by the changing position of the moon or the attraction which gravitation exerts on an object weighing only one twenty-nine-thousandth part of an ounce. Gold-surfaced mirrors, each a half inch square and held by a beam consisting of a quartz thread as fine as gossamer, correspond to the scales in the balances. The weight is attached to the underside of one of the mirrors. It is constantly being affected by the changing relative positions of the sun, moon and earth, and is counterbalanced by 150 twists in the quartz thread which exerts a constant pull. Changes in weight are recorded by the shifting of a shadow produced by the displacement of waves of light from a mercury lamp and reflected upon the mirrors. The shadows become narrower or wider according to the relative position of the mirrors. The balances are being used to locate oil deposits. Oil, being lighter than other parts of the earth's crust, causes a decrease in gravitation. Surveys are made over an area at 1,000-foot intervals. Wherever the scales show a relatively slighter attraction, a test boring is made for oil. The instrument also provides a test for the validity of the Einstein theory, which holds that impulses of gravitation have the same speed as light. If this is true, the moon should exert its pull one and one-third seconds after it passes a given spot, the time it takes light to get to the earth from the satellite. The scales are adjusted to measure any changes in gravitation that take place in a fifth of a second because of the moon. Because of the vibrations due to street cars and other traffic, delicate tests such as this cannot be made except in secluded spots. The scales are said to be 100 times more sensitive than the most delicate instrument known before their invention. They weigh fifteen pounds and although they must be protected from changes in temperature, are fairly sturdy.

VISION SHIELD FOR AUTO GLASS PREVENTS FORMING OF FROST

Held to the automobile window by rubber vacuum cups, a strip of transparent material now on the market, keeps frost or mist from forming on the glass. It is easily removed or attached, can be cut in neat shapes and is said to be effective even in the coldest weather.



Peepholes through the Frost; How the Shields on Auto Glass Aid the Driver

© Henry Miller

This Man Is Paid to Nick Dishes. The Weight Is Drawn Back, Then Allowed to Strike against Plate; the Force of the Blow Is Indicated on Dial

Saving Our Dishes from Breaking

Government Scientists Shatter Cups and Saucers to Test Strength and Durability of Crockery

By UTHAI VINCENT WILCOX

DID you ever drop a dish and it failed to bounce—just went to pieces before your eyes? Did you ever nick the best plate or the favorite tea cup? Did you ever have one of your dishes accidentally fall to the hard, unyielding tile floor at the soda fountain—and everyone craned to look your way? If any of these experiences were ever yours, you have fervently wished that some one would invent some unbreakable crockery. "Oh, if only china could stand a little hard usage," you moan.

But think of the hotel managers and the restaurant keepers! They, too, would like to have some of the unbreakable kind of crockery. Yes, indeed they would, when they pay untold thousands of dollars a year because dishes will break. It is a fact that one eastern hostelry of international repute spends more than $60,000 annually for new dishes and glassware to replace those broken in handling. A leading Chicago hotel has to count in the budget $35,000 to replace chinaware alone. Restaurant keepers regularly charge for a twenty-per-cent dish breakage each year. And that charge must be paid for by the patron of the restaurant, hotel, and eating house where crockery is used.

So, breaking dishes becomes something of a national problem touching the pocketbook of every man and the budget of every housewife. If it were possible to tabulate the dish-breakage losses throughout the United States, the total would look like interest on what Europe still owes us. Everytime we eat in a restaurant, or a hotel, or at home we share in the sum total. But cheer up. This is to bring you good news and not to add to your resentment at the high cost of living. It is a fact, thanks to a group of scientists who labor for us at the bureau of standards, that dishes are now growing up—they get older in service and stand harder knocks without collapsing. These scientists have made machines that subject the dishes

to the same usage that you do or the amateur or professional dishwasher and waiter. They have just stopped short of using heavy artillery and high explosives. All of which, incidentally, gives a conception of rough usage that science gives to crockery with the expectation of helping users and manufacturers to obtain cups, saucers, and plates, and all the rest, that will not break except the heavens fall.

One dish-breaking outfit made by Uncle Sam's men consists of a heavy weight against which the plate is held. The investigator-of-the-truth-about-dishes draws back a steel ball attached to a pendulum arm, letting it fall against the plate. If the plate doesn't break with the first hit, he tries it again and again, all the time increasing the distance that the steel ball has to travel as measured off on a graduated scale.

The strength figures indicated on the scale are noted down, and as the plates break at this figure or at that, it all goes into the record. The plate that can stand the most is the plate that wins, and by such a process are better plates made. The same steel shot is also used on the plates to find out how much they will stand before nicking. It's something like hitting the faucet over the sink with the plates, cups and saucers when washing the dishes for Friend Wife.

From Top to Bottom, Rack That Exerts 100,000 Pounds' Pressure on Dish; Another View of the Breaker in Use and Kiln for Heat and Cracking Tests

The tumbler tester helps the alibi—"the bottom just dropped out; honestly it did!" The glass is placed so that its bottom is exposed. The iron ball attached to the pendulum is then drawn back the graduated distances and released. The weight rams into the bottom of the glass. And some of them stand it. According to these scientists, the tumblers and glasses that stand such treatment have strength enough to survive a four-foot drop to a concrete floor.

Other tests include sudden heat and cold. Extremes of each are given to simulate conditions to which these culinary articles are subjected in the commercial restaurants or hotels where mechanical dish-washing machines play havoc. Boiling tests are given to glassware in order to find the kind that will endure the most.

But the dishes that grace the dining table are not the only victims of this pounding and hammering and sliding and chipping and dropping and heating—window glass comes in for its share. How much will your window pane stand if Dick bats his ball against it? This may not be the way the problem is stated in the scientific papers of the bureau, but that is what it amounts to. How much storm pressure will your window stand on a wild, gusty night when the whole house shivers in the blast and the thunder reverberates even beneath the blankets?

In the government laboratory wind pressure is simulated by water pressure, which is so regulated that it duplicates the vagaries of the wind. Hammers and steel balls test for the sudden breakage as when the rock goes astray from the urchin's hand.

To do this, a piece of the window glass is placed on the testing machine lying flat. A saddle is suspended over the unsupported central portion of the glass. This saddle is connected with a swinging arm similar to the ordinary scale arm. A standardized bucket is placed on the far end of this arm so that it will catch all

© Henry Miller

the shot that flow from an adjoining shot tower when the gate is opened. The shot pouring on the bucket that rests on the scale beam, which, in turn, is fastened to the saddle, exert a constantly increasing strain on the glass. At last, when this machine has poured out more shot than the glass can stand, it breaks, and in so doing pulls a trigger that stops the flow of shot. The weight of the shot in the bucket gives the transverse strength of the glass.

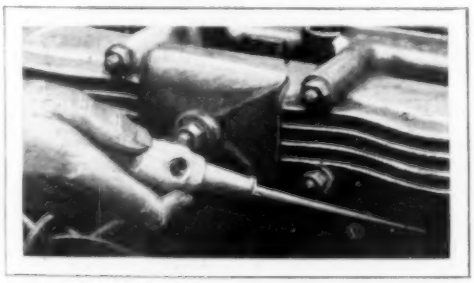
These and other tests are studied intensively by architects and engineers, and as a result, your house, your store, your office windows are made to withstand the necessary strain.

Such tests by cold and calculating science have established one fact that is interesting to buyers of crockery, glass and china, and that is that the made-in-America ware has come through with better marks than the imported dishes. These demon dish destroyers have found that, as a rule, the homespun plates, cups and saucers are more durable than the best of the foreign brands.

American hotels have been interested, because it will save a large bill of lading from European sources, which in turn will make cheaper eating.

SCREWDRIVER FOR AUTO KIT TESTS SPARK PLUGS

A tester for spark plugs and a screwdriver have been combined in one useful implement for the auto tool case. In trying the plugs, the flash, if visible at all, is



Opening in Side of Screwdriver Exposes Visible Flash in Making Spark-Plug Tests

seen through an opening in the side of the handle, which is so arranged that the user is protected from shocks likely to be suffered if he were working with an ordinary screwdriver.

¶According to estimates, about one per cent of the bituminous and twenty-five per cent of the anthracite-coal resources of this country have been mined.

LEVER SHEARS TO CUT STEEL REDUCE WORK AND COST

Steel sheets or bars up to a quarter of an inch in thickness are cut smoothly or slit with little difficulty in lever shears a

Metal Shears in Operation; Slight Pull Exerts Great Leverage on Blade

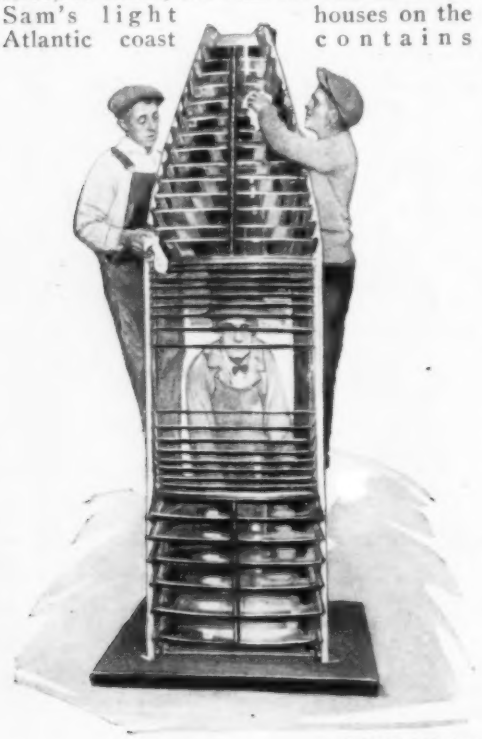
western inventor has patented. The jaws are so hinged that the blades do not get out of alinement, assuring clean, straight edges both in cutting and in slitting. Great leverage is applied from the handle with but a slight pull.

LENGTH OF LIFE IS INCREASED TWENTY-ONE YEARS

Largely through the aid of efficient hospitals, the average length of human life in this country has been increased twenty-one years in the past generation, according to a Chicago physician. He predicts that another twenty-one years will be added in the next half century so that it will be "unnecessary if not negligent for anyone to die before he is seventy-five years of age." One of the aims of the American Hospital association is to provide homes for patients who are recovering so that beds will be available in the hospitals for acute cases. Grading of nurse education is also being developed as one of the institution's most important activities, and it is said that the hospitals of America have more young women students than the universities and colleges.

GLASSES IN LIGHTHOUSE LENS OF THIRTY DIFFERENT SHAPES

Capable of intensifying light more than 1,000,000 times, the lens for one of Uncle Sam's light houses on the Atlantic coast contains



© Kadel & Herbert

Polishing the Huge Glass Lighthouse Lens; Pieces Are Set to Intensify and Focus the Rays

glasses of thirty different shapes. They are so arranged that the beams are reflected and focused so efficiently that radiance from the oil lamp, which is the light source, is visible for several miles.

PERIL OF ARCTIC TRIPS SHOWN IN BIG TOLL OF SHIPS

The successful return of MacMillan and Amundsen from their latest expeditions to the north, recalls that many earlier explorers gave their lives to Arctic adventure and that a long line of sturdy ships has surrendered to the ice. Less than two years ago, William Nutting and three companions set out from Norway to follow the Viking trail to America in their little ship, the "Leif Erickson." They disappeared after leaving the coast of Greenland. Earlier centuries had their Arctic expeditions. In 1500, Gaspar Cortereal, a Portuguese explorer, ventured into Hudson strait in a small craft and was never heard from again. His brother and a number of companions who organized a searching expedition, likewise were lost. Four hundred years before there was a map of the Arctic, Sir Hugh Willoughby sailed into the north, later to be found dead with his crew and the ship frozen fast in the ice. Sir Martin Frobisher's search for the northwest passage in 1590 met with partial disaster when one of his three ships foundered in a gale. Bering made many expeditions during the middle part of the eighteenth century, but was finally wrecked on the island that now bears his name, and died, there, legend says, of a broken heart. After a successful voyage into northern seas with Peary, in 1893, and a relief expedition a year later, the "Falcon," commanded by Capt. Henry Bartlett, a skilled navigator, was lost with all her crew. The first "mariner of the air" to be claimed by the Arctic was Salomon August Andree, who, with two companions, left Spitzbergen in 1897 in a balloon fitted with sails and trailing ropes. They hoped to reach the pole and return, but a few of the buoys dropped from the basket as a means of tracing the expedition and a message brought by a carrier pigeon, were all that came back of the ill-fated venture. In May, 1845, Sir John Franklin, with 129 men and the "Erebus" and the "Terror," set out to find a northwest passage. Neither the ships nor any of the men returned. Thirty relief expeditions, over as many years, were sent in search of them, although a message found fourteen years after the men had sailed, stated that the ships had been crushed in the ice.

WEDGE-SHAPED AIR CUSHION ADDS TO AUTO COMFORT

Motor drivers are spared fatigue on long journeys by using an inflated, wedge-shaped cushion that may be adapted as a seat, as a back rest or as a buffer or pillow for the head, neck and shoulders. It also places a short person nearer the steering wheel. It is made of a rubberized material in various colors, and when deflated occupies but little space. Blown up, it is sixteen and one-half by eighteen inches.

The Air-Mail Pilot's Headphones Are Built Right into His Helmet, So That When He Puts It On, He Is Ready to Tune In on the Radio Receiver in the Corner of the Cockpit

Radio to Banish Chief Danger in Flying

Air-Mail Experimental Laboratory Perfecting Wireless Guiding Beacon and Altitude Finder to Protect Flyers in Fogs

IN a tiny shack hardly twelve feet square, set down at the edge of a cornfield on the Illinois prairie a few miles from the Mississippi river, two revolutionary inventions are being perfected to remove the worst dangers which confront airmen.

One of the devices is a radio beacon, or compass, which will enable a pilot to fly straight from one point to another through the thickest fog or the darkest night. The other is a radio altitude finder, or altimeter, which will keep him at a safe height above the ground, free from the danger of crashing through fog or darkness into some mountainside.

The prairie laboratory is the experimental field of the United States air-mail service. On one side of the rutted country road, in a small clearing reclaimed from the surrounding cornfields, is the tiny experimental laboratory and the tall wooden lattice masts of the radio department. Across the way, at the edge of a meadow big enough for a plane to land and start, are a two-ship hangar, offices and shop. The place, at the edge of Monmouth, is many miles south of the transcontinental air-mail route, so that work can be carried on without any interruption from the planes that day and night flash through the sky. In this out of the way spot, southwest of Chicago, most of the development work for the air mail is carried on. A measured test course stretches away to the south for the testing of new planes, both those built in the air-mail shops at Maywood field, Chicago, and new designs submitted by manufacturers. Three new types were tested a few months ago and models picked to replace the DeHavilands, which have been standard since the service started. In the radio laboratory, however, the most work is being done. The wireless beacon, originated by the bureau of standards, improved by the army signal and aviation sections at McCook field, is being perfected for standard air-mail and commercial flying. Like the beacon lights which stretch from New York to the Rockies along the night-mail routes, the radio apparatus of the air-mail service will be at the disposal of every commercial flyer, as well as mail or service pilots.

The radio beacon has already been tested successfully over distances of more than 200 miles on long wavelengths, well above the usual commercial range, and tests are now being made on sixty meters, with the idea that the shorter waves will

Photo-Diagram of How the Radio Beacon Works; the Code Signals Sent Out on Each of the Triangular Aerials Interlock in One Zone to Form a Continuous Guiding Signal

not only eliminate much of the static interference, but, by using less power, will make the stations cheaper to build. With the present equipment, each station would cost about $6,000, and it would take some fifteen or sixteen to span the continent on the New York-San Francisco mail route alone. The altitude finder, based on apparatus designed for the air mail by C. Francis Jenkins, inventor of the radio movies and a process for transmitting photographs by wireless, is still in the experimental stage, but already shows promise of success.

In addition to its other work, the experimental division also is testing the Jenkins picture transmitter with the idea of handling the air-mail orders between stations by sending a facsimile of the written sheet instead of trusting to the dots and dashes of wireless code. Eventually the picture system may be available to mail patrons as an additional way of transmitting a letter, faster by far than either train or airplane. In six minutes an exact facsimile of a letter, signature and all, could be transmitted from coast to coast and then delivered by special messenger. The service, it is believed, would be specially useful to banks and lawyers, as it would be proof of genuineness, a point that is not true of telegrams.

The idea of a radio beacon to guide airplanes from point to point originated in Germany as far back as 1907, and was used with varying success to direct the Zeppelins in their raids on London, but in its present form it is purely an American development. It is based on the fact, which every owner of a radio-receiving loop has learned, that the loop antenna has a directional effect and receives its strongest signals when pointed straight toward the transmitting station, while, when turned at right angles to the sending point, it fails to pick up the broadcast at all.

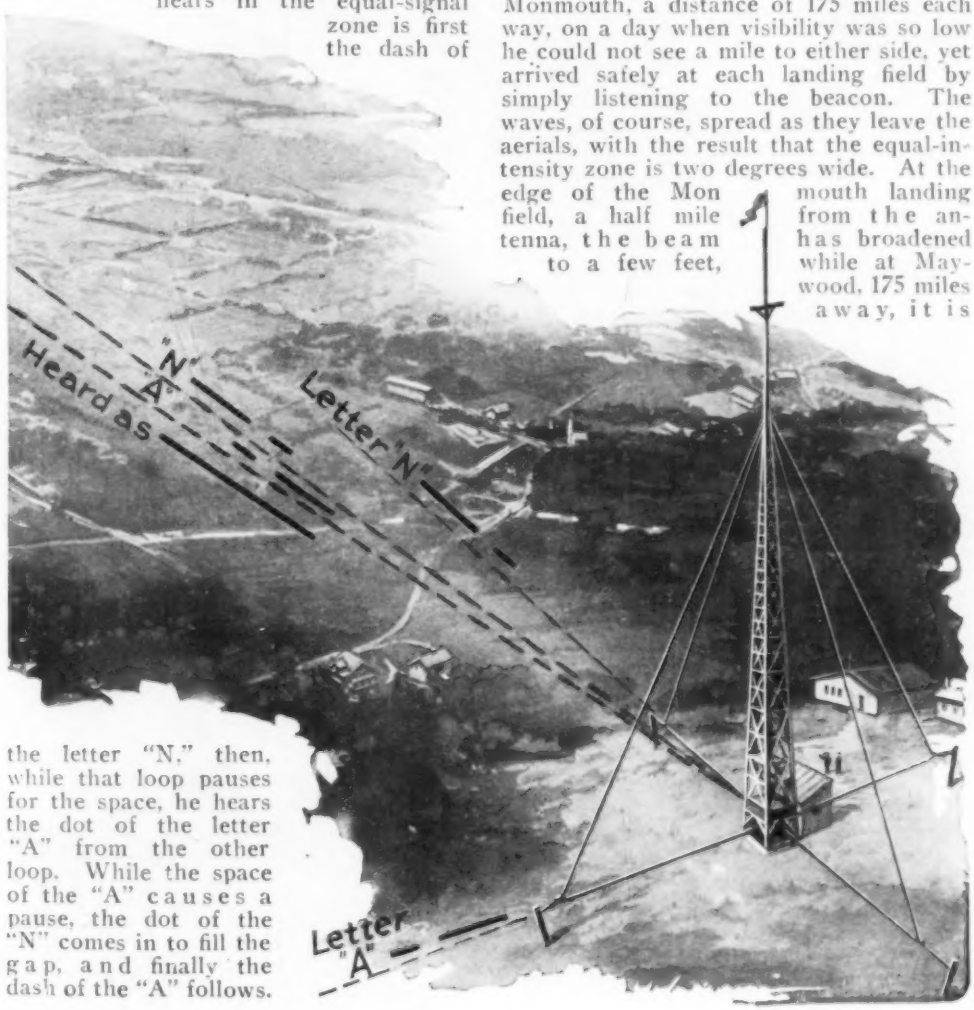
The same properties of receiving loops hold good when the sending station uses an antenna of this form, but in the radio beacon the air mail uses not one loop but two. They are of triangular shape, supported from a single wooden mast about seventy feet high, with the base wire eight feet above the ground, and 250 feet long.

The two loops are erected at right angles to each other. An automatic sending device transmits the letter "N," a dash and a dot in wireless code, on one loop, and sends out the letter "A," a dot and a dash, or just the reverse, on the other loop. An aviator with a receiving set, if he were in line with either loop, would receive only the signal transmitted by it, but halfway between the two, he would pick up both signals with equal intensity, while on either side of the halfway point, the farthest signal would gradually fade away, while that from the nearer loop grew stronger as he approached it.

The sending arrangement is such that when the flyer is in the equal-intensity zone, the two signals interlock. A wireless dash is twice as long as a dot, and a space equals a dot. What the aviator hears in the equal-signal zone is first the dash of the letter "N," then, while that loop pauses for the space, he hears the dot of the letter "A" from the other loop. While the space of the "A" causes a pause, the dot of the "N" comes in to fill the gap, and finally the dash of the "A" follows. The interlock of the signals, however, turns all that into one long dash, a considerably magnified letter "T."

As long as the pilot, at five-second intervals, hears a steady "zzzzzzzzzzz" in his phones, he knows he is right in the wireless beam and on his true course. But if that steady sound breaks up into separate signals, one half loud and the other faint, he is off to one side. If he is to the right, while flying toward the Monmouth beacon, there will be a loud "zzzz" for the dash of the "N," then a fainter "zz" as the dot of the "A" comes in, followed by a loud "zz" and a fainter "zzzz." If he is to the left of his course the signals will be reversed, the first faint, the second loud, and so on.

Pilot Burnside, of the test division, made a round trip from Maywood to Monmouth, a distance of 175 miles each way, on a day when visibility was so low he could not see a mile to either side, yet arrived safely at each landing field by simply listening to the beacon. The waves, of course, spread as they leave the aerials, with the result that the equal-intensity zone is two degrees wide. At the Monmouth landing field, a half mile from the antenna, the beam has broadened to a few feet, while at Maywood, 175 miles away, it is



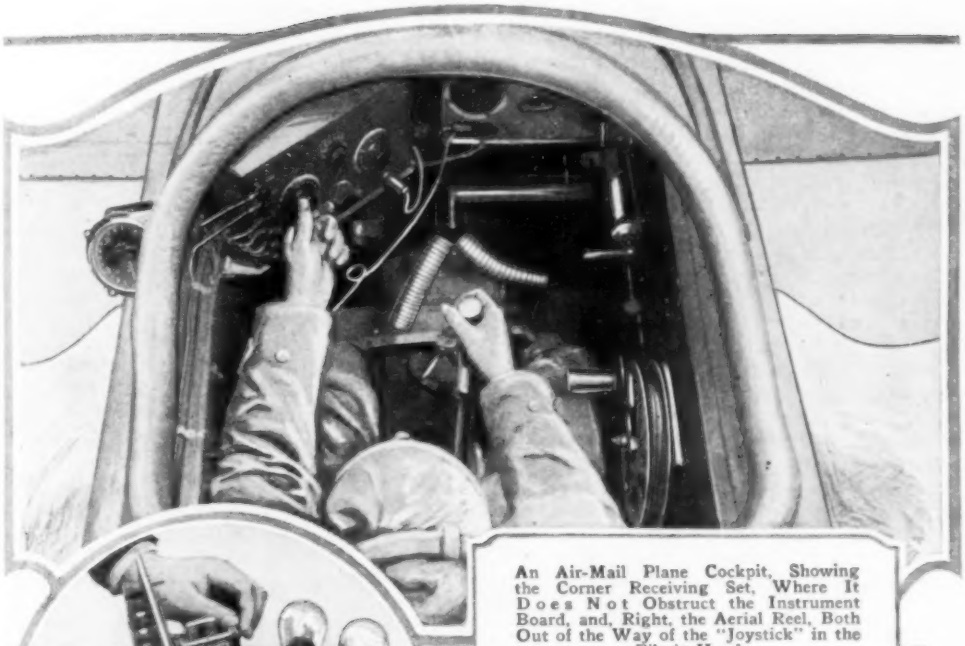
about five miles wide, hence easily located by a pilot flying toward that field.

While, if both aerials contain exactly the same amount of wire of the same resistance and the same amount of current is used to send the signals in each, the equal-signal zone will be halfway between them, the zone can be changed at will by increasing the current in either aerial. No three of the air-mail fields are in a direct line, and after a pilot has flown from one to another in one beacon zone, it is necessary

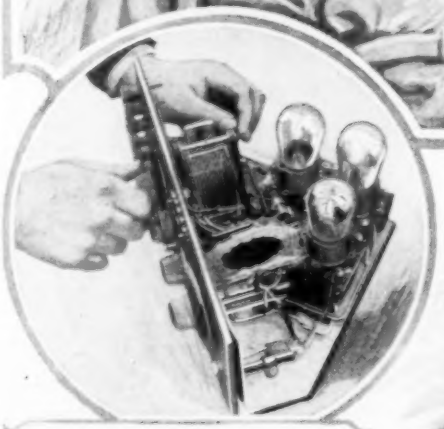
Radio Altitude Receiver and Sender and How Signal Reflected from Earth Lights Lamp at Certain Height

to shift the beacon to guide him on to the third. The shift is accomplished accurately with a device called a goniometer, which can be set instantly for any point on the compass after it is once calibrated.

The transmitting set used is a standard radio telephone, so that the operator in charge can cut in at any time to transmit weather reports, orders or other information to the pilots. At present, the pilot will have no way of talking back, but a light sending set to be carried in the planes is also be-



An Air-Mail Plane Cockpit, Showing the Corner Receiving Set, Where It Does Not Obstruct the Instrument Board, and, Right, the Aerial Reel, Both Out of the Way of the "Joystick" in the Pilot's Hand



The Beacon Receiver Is Built Triangular to Fit in the Corner of Cockpit, Giving Unusual Grouping of the Tubes

With the Goniometer, at the Left, It Is Possible to Direct the Radio Beacon to Any Point Desired by Merely Shifting the Revolving Pointer; the Queer Apparatus in the Foreground, Driven by the Small Motor, Carries Notched Disks Which Automatically Send Out at Five-Second Intervals the Dots and Dashes Which Interlock to Guide the Plane; Above Is a Big Rectifier, Which Changes Alternating Current to Direct Current

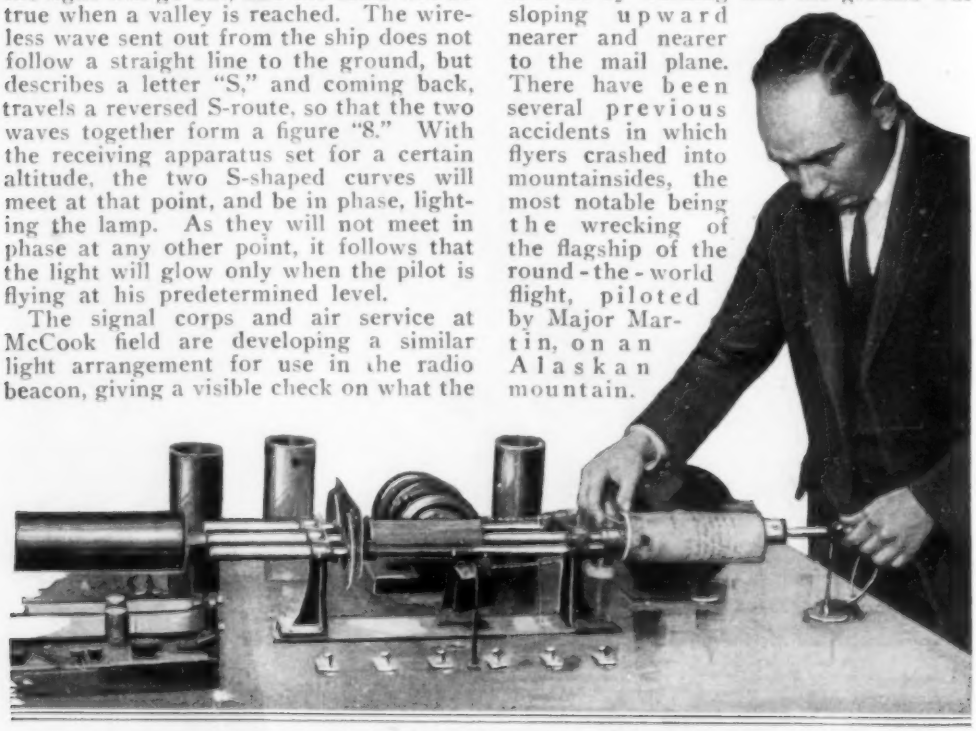
ing developed at Monmouth. The radio altitude finder, being developed on the Jenkins idea, is even simpler than the beacon. It consists of a very small transmitting set, using only two ordinary radio-receiving tubes, and a small three-tube receiver. The pilot has only to turn on the sending current, which transmits an electrical wave to the ground, from which it is reflected back to the plane. A sensitive instrument on the receiving-set panel will measure the strength of the return signal, but instead of being calibrated in milliamperes, the instrument dial will show feet, since the strength of the returning signal will vary in accordance with the height of the airplane above the earth. The scale will read backward, the higher the plane flies the weaker the current returning.

Experiments are also being made in using a tiny electric-light globe filled with neon gas to give a visible signal. With it, the receiving apparatus will be set for any desired height above the ground at which the pilot wishes to fly. When the plane reaches that altitude, the light will come on, and remain on so long as he keeps his height. If the plane passes over a hill the light will go out, and the same will be true when a valley is reached. The wireless wave sent out from the ship does not follow a straight line to the ground, but describes a letter "S," and coming back, travels a reversed S-route, so that the two waves together form a figure "8." With the receiving apparatus set for a certain altitude, the two S-shaped curves will meet at that point, and be in phase, lighting the lamp. As they will not meet in phase at any other point, it follows that the light will glow only when the pilot is flying at his predetermined level.

The signal corps and air service at McCook field are developing a similar light arrangement for use in the radio beacon, giving a visible check on what the pilot hears in his phones. Three small lights will be used, red, green and white. If the plane strays to the left of its course, the red light will burn; if to the right, the green will come on, while when the ship is in the interlocking beacon course, the white light will record the fact.

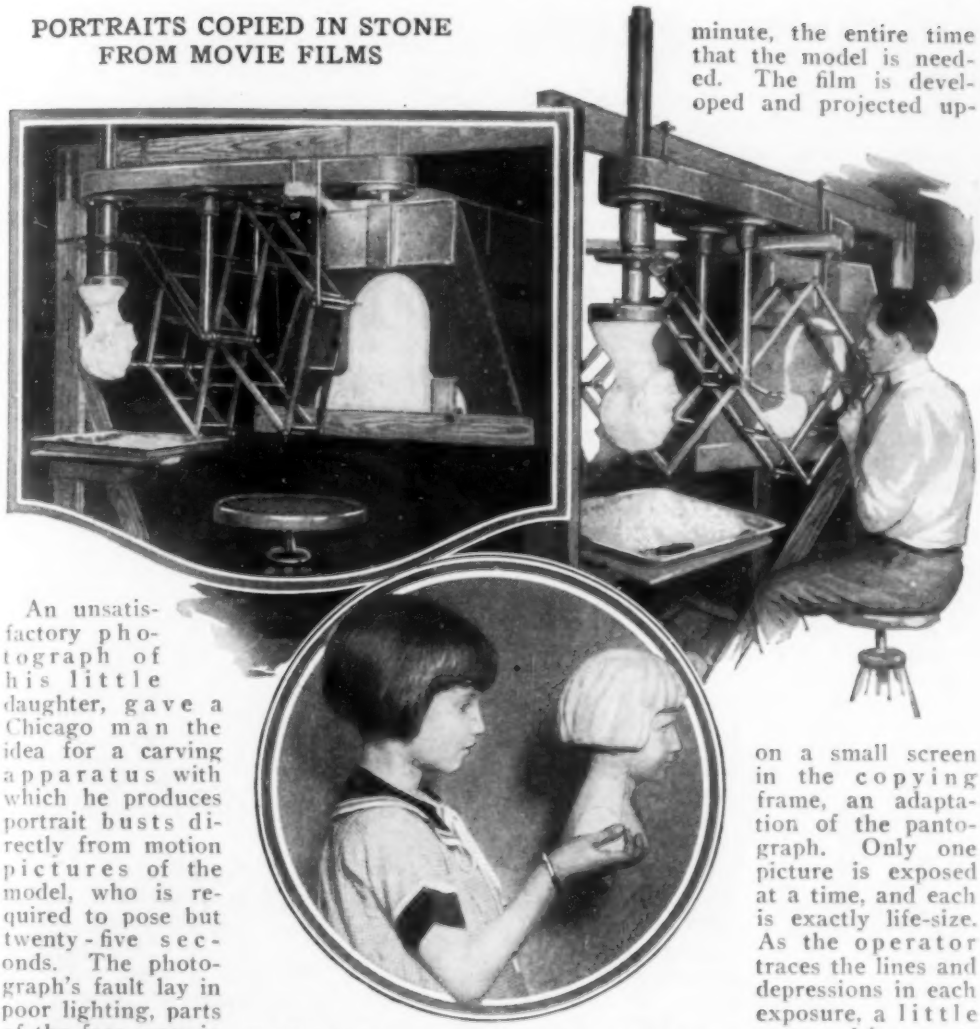
The beacon, post-office officials believe, would have averted many accidents in the past, notably the tragedy which cost the life of Pilot Ames only a few weeks ago. Leaving New York with the night mail, he became lost in the fog, and eventually crashed into a mountainside while trying to land beside one of the airway lights only six miles from his landing field at Bellefont, Pa. Had he been flying by radio compass, the interlocking signals would have guided him direct to the field. Some idea of the difficult terrain over which the night-mail flyers wing their way may be gained from the fact that, though Ames fell within six miles of his field, it took searchers ten days to locate the ship, the pilot being found dead at his controls. He had been struck on the head by a bit of flying wreckage.

The altitude finder would likewise have saved him from crashing into the mountainside by warning that the ground was sloping upward nearer and nearer to the mail plane. There have been several previous accidents in which flyers crashed into mountainsides, the most notable being the wrecking of the flagship of the round-the-world flight, piloted by Major Martin, on an Alaskan mountain.



Radio-Picture Apparatus Used to Transmit Written Orders. Instead of Code; Some Day the Post Office May Send a Picture of Extra-Special Delivery Letters in This Way

PORTRAITS COPIED IN STONE FROM MOVIE FILMS



The Copying Frame, the Artist at Work, and Daughter Holding a Bust of Herself

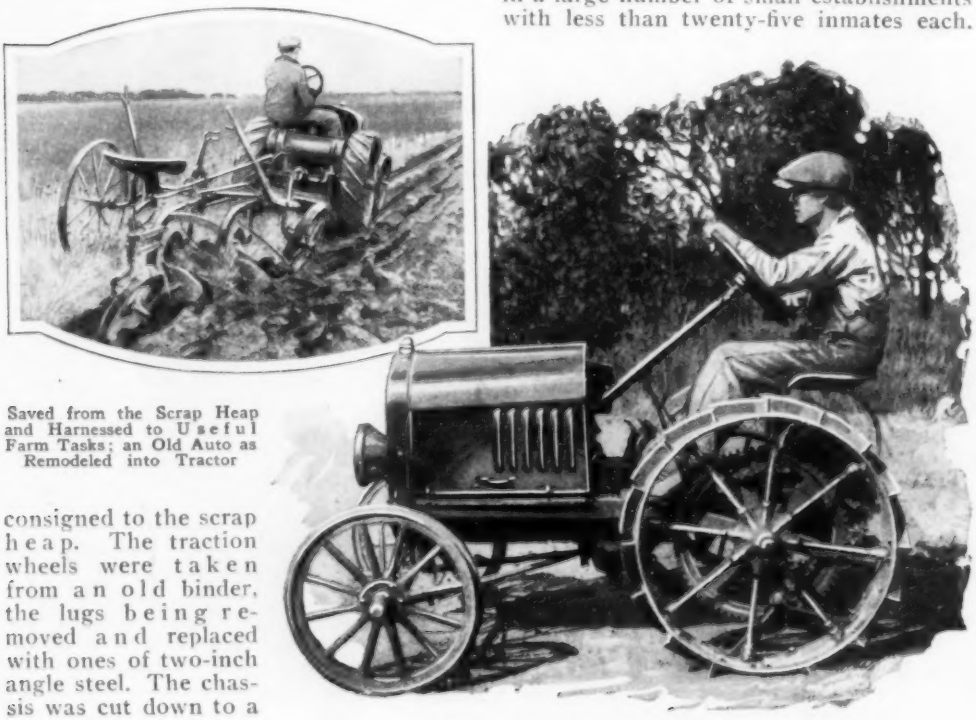
An unsatisfactory photograph of his little daughter, gave a Chicago man the idea for a carving apparatus with which he produces portrait busts directly from motion pictures of the model, who is required to pose but twenty-five seconds. The photograph's fault lay in poor lighting, parts of the face were in deep shadow, others too prominent. But in these masklike lines were the high lights and shadows a sculptor so carefully studies. The father, a mechanical engineer with a sense of the artistic, realized that a series of such pictures, taken from many angles, would give sufficient data for a bust. He therefore worked out his process, which consists in two main steps, taking the pictures and reproducing them in the desired material, stone, plaster of paris, marble or other substance. A pivot holder for a motion-picture camera is so adjusted that the instrument can be revolved completely around the model who sits in the center of the camera's orbit. Four hundred exposures are taken during only one rotation, which requires less than half a minute, the entire time that the model is needed. The film is developed and projected upon a small screen in the copying frame, an adaptation of the pantograph. Only one picture is exposed at a time, and each is exactly life-size. As the operator traces the lines and depressions in each exposure, a little motor-driven cutter attached to the other end of a swinging arm which supports the copying instrument, reproduces the image of the film in a block of the material of which the bust is to be made. A turn of a crank exposes a new picture and at the same time shifts the bust so that the lines cut upon it will conform to the planes exposed on the fresh view. By the time a complete revolution has been made, the block has assumed what is virtually an exact copy of the camera's record. A particular advantage of the process, it is claimed, is that busts of children may be made with little difficulty, a feat that often the most skillful sculptors are unable to achieve because the young models will not hold still and it is hard to produce a life-like expression.

CARILLON DIFFERS FROM CHIME IN NUMBER OF BELLS

Highest and lowest notes on a set of chimes have a difference of little more than an octave and an average of ten bells composes the installation, while a carillon must have a range of at least two octaves, a minimum of twenty-three bells. It attains a maximum compass of four octaves and a half, or fifty-three bells, as is the case with the carillon in the Park Avenue Baptist church in New York City. Many different melodies as well as harmonies or chords to accompany them are rendered by the carillon, and mastery of the instrument is difficult. In Belgium, there is a national school for instructing "carillonneurs," the art being taught with as great thoroughness as other music branches.

OLD AUTO MADE INTO TRACTOR WITH BINDER WHEELS

By cutting down the chassis of an old automobile and making other alterations, the car was remodeled into a serviceable tractor that pulled one sixteen-inch or two twelve-inch plows with little difficulty and did other duties about the farm. Practically the entire outfit was constructed from what ordinarily would have been consigned to the scrap heap. The traction wheels were taken from an old binder, the lugs being removed and replaced with ones of two-inch angle steel. The chassis was cut down to a wheelbase of fifty inches and a tread of about thirty-six inches. The rear axle and housing were shortened and oxy-acetylene-welded to make a jackshaft which was fitted with a pinion on each side, to mesh with the driver gears on the traction wheels. The tractor turns in a fifteen-foot circle, has a speed of two to two and one-half miles an hour, and besides handling plows, can drag a seven-foot or nine-foot harrow or three thirty-one-inch lawn mowers.



Saved from the Scrap Heap and Harnessed to Useful Farm Tasks; an Old Auto as Remodeled into Tractor

YEARLY COST OF EACH PAUPER THREE HUNDRED DOLLARS

Maintenance of a pauper in the United States averages $334.64 a year, and each has 2.14 acres of land cultivated for his support, figures from states of the union show. The value of buildings and equipment devoted to their care is $1,118.96 per person. Wide differences were discovered between the states. For instance, in Nevada the cost each year per capita of inmates in almshouses is $865.10, while in Alabama it is only $187.53. Property investment per person cared for in the charitable institutions and on the poor farms of South Dakota is $5,600, and but $415.63 in Mississippi. A reason for the high expense in certain localities was seen in a large number of small establishments with less than twenty-five inmates each.

Unwary Owners Who Do Not Read Their Policies and Understand What They Cover, Often Lose for Failure to Obey Rules

AN autoist, hurrying down a narrow street, speeded up to pass a street car so he could turn into the track to go around a parked car. His effort to save a minute wasn't a success. With his car turned into the tracks at an angle of forty-five degrees, the street car caught its left side and shoved the right into the parked machine. Traffic was tied up for more than half an hour while the mess was unscrambled. The loss in time to those delayed, and the disruption of street-car service probably cost considerably more than both automobiles were worth. But that's another story—this one is about insurance.

Both the automobile owners had full coverage, and so their grief was somewhat allayed—until they tried to collect. After the wreckage had been removed from the right of way, the man who had lost a half hour and the use of his car by trying to save a minute caught a taxicab and hurried to the office. Pressing business occupied most of the morning, but about noon he remembered to notify his insurance agent. He explained the accident and the insurance office was very sympathetic, but very sorry. He was advised to read his policy again, and note particularly a clause which provided that, after an accident, the owner should remain with the wreckage until the insurance adjuster or garage man arrived.

The insurance company was properly sorrowful for his predicament, but he had left his car unguarded for hours, and that nullified its contract and he could collect nothing. And, as if that wasn't enough, the insurance company likewise pointed out he had violated another clause of his contract with it by not reporting the accident promptly.

The other fellow, the innocent victim of the accident, whose car was standing still at the curb with no one in it, and who couldn't possibly in any way have been responsible for the accident or have avoided it, knew all about reporting accidents and guarding the wreckage to prevent pilfering of usable parts, which is the thing the insurance company seeks to guard against by inserting that clause.

He took the names and addresses of all the possible witnesses, got the story of the street-car motorman and the license number of the offending car, and then hopped into the nearest store, and, with one eye on the wreckage, called his insurance agent. The latter listened to his story and then explained he was very sorry, but the insurance issued by his company didn't cover the situation. The insured car, he explained, was standing still at the curb and his company's policies only covered damage incurred in accidents occurring while the car was in motion.

The only protection for the auto owner is to read and reread his policy until he knows every clause by heart, and, what is more important, understands the real meaning of the legal verbiage in which that meaning is guised. The insurance company tells you to read your policy, and prints that advice on it. If the insured fails to carry it out, the company is justified in disclaiming responsibility when you break the specific terms of your contract. Yet how many owners know what those terms are?

Suppose you are driving along the street; your attention is attracted by something in a store window; you look away for an instant, and ram the car ahead or brush a pedestrian aside with a fender. Do you get out and apologize for your carelessness or do you bawl out the other fellow for being in your way?

When You Brush a Pedestrian with Your Fender, Do You Stop to Get His Name and Report the Affair to Your Insurance Company? He May Sue You Months or Years from Now; If You Knock Down a Cyclist, Do You Know How to Make a Settlement?

The first is the polite thing to do, but if you do it and he comes back with a suit for damages, you might as well kiss the money goodby, for your insurance company very probably will not stand behind you. You have violated another term of your contract, which says you must accept no liability for any accident, and when you apologized you implied you were responsible. The insurance company naturally does not want to pay any damages without a fight, if there is any chance of winning that fight, and when you accept the responsibility, you have made it impossible for the company to fight.

You may have only brushed the pedestrian with a fender—not even knocking him down—and decided he wasn't damaged, so went right along without getting his name or reporting the facts to your insurance company. But he caught your license number, and a day or two, or a week or a year or several years later, he may go to the hospital, claim he was injured by your car, get medical treatment, and then sue you for $50,000 or $100,000 damages. If he does, you haven't a leg to stand on with your insurance company. You didn't take the pedestrian's name and you didn't report the accident to your insurance agent promptly, as required. The company washes its hands of you, and you can face the jury alone. Suppose the pedestrian you hit is an eleven-year-old

boy playing in the street. He isn't injured much, outside of a strained back, and in a few days he recovers from that. You are very sorry for having hurt him, and gladly pay the doctor's bills and a bit besides, and, being a careful person, ask his mother, who is present, to sign a release from all damages.

Let ten years pass, and you have forgotten all about the affair until one day you are served with a summons in a damage suit for $100,000. The eleven-year-old boy of ten years ago has just turned twenty-one; from some cause has become hopelessly paralyzed, and, under the advice of a doctor or lawyer, has decided that the slight injury a decade before is responsible for his condition.

Spare Tires and Other Removable Equipment Are Not Ordinarily Covered by Insurance, But May Be if the Thief Tried to Steal the Car Too

Being a careful person, you put the release from all damages in your safe-deposit box and you bring it out and take it to your attorney. He investigates the case and then explains that in your state only the father can sign such a release for a minor child, and, as the father was away from home when you gave the lad a cash present and got his mother to sign the release, the paper is of no value.

You go into court. The boy, just on the threshold of manhood, is there with his physicians who will testify that he is a hopeless invalid for life. His potential earning power as a healthy man for the expectancy, or probable length of life, which insurance actuaries would credit him with, would amount to such huge figures that a sympathetic jury may not feel his claim for $100,000 is at all too high.

Perhaps this case doesn't fit you—yet. You are insured, and if you hit a boy tomorrow, the insurance company, you say, will protect you. It will, up to the limit of your policy, but is that policy written to provide $5,000 damages for injury to one person and $10,000 for injury to two, or is it for some higher figure? And how far will $5,000 or $10,000 go in paying off a judgment for $100,000?

You may have one of the bigger damage policies, paying $100,000 for death or injury of one person and up to $300,000 for death or injury of two, and in that case you are fully protected, if—and note this carefully—the company which insured you is alive and paying damages ten years from now. Is your insurance in an old and established company which has a reasonable expectancy of being alive a decade from now, or did you shop around for the cheapest rates you could get, and buy a policy in some struggling concern which may have a run of hard luck because of too many damage claims and go into the hands of the receiver?

You can get good insurance that will cover every possible situation, if you pay for it, and get it in a company which writes policies with fairly reasonable clauses and avoids the jokers. The insurance you buy can be varied to suit your purse and your needs, and if you understand insurance you can save enough on some items to get extra protection on others. Suppose you store your car in a fireproof garage, where attendants are forbidden to smoke, that you always stop your engine before filling the gasoline tank, and that the make is a good one, with a well protected electrical system which has a good reputation for not catching fire. Under those circumstances you

might take a chance and dispense with fire insurance, or cut it to a minimum.

You may be able to save on theft insurance. Do you make a habit of leaving your car on the street for any length of time, and at the same place, where thieves can become accustomed to your movements? Is it a make popular with thieves; are you absent-minded and apt to leave it unlocked; if you have a private garage, is it likely to tempt thieves, and if you store your car in a public garage, is the owner a responsible person? All those things affect the amount of theft insurance you will need.

Collision and property-damage insurance will depend upon your carefulness as a driver, your nervousness and quickness to react to an emergency, whether other members of the family drive your car, whether you drive in congested districts, whether you have bumpers and a stoplight, the weight of your car, and whether, in an accident, it is more apt to inflict than suffer damage.

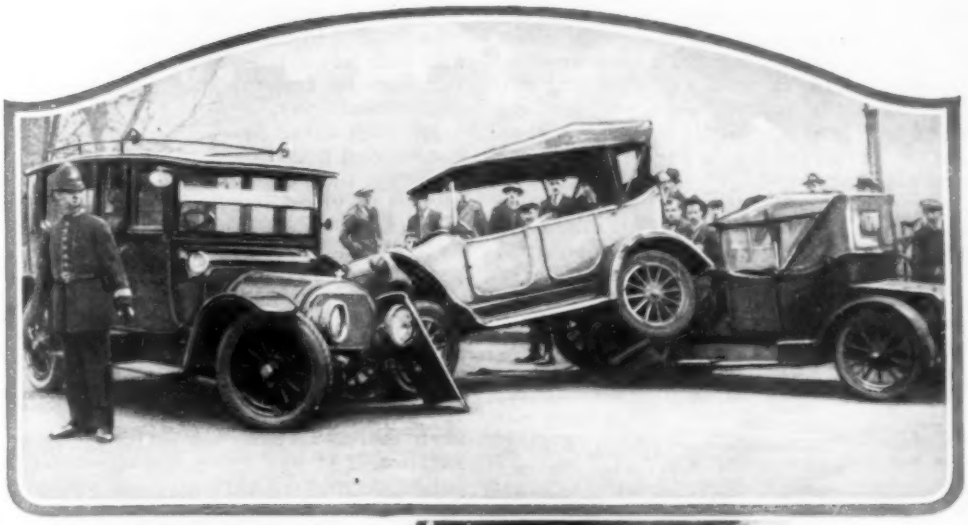
Liability coverage is something every one needs, and with the verdicts awarded in damage suits during the last few years showing a constant tendency to rise, the motorist cannot be too well protected.

When you buy a policy be sure whether it reads "insure" or "indemnify," for there is quite a difference. In a liability policy the company agrees to insure or indemnify you against loss by reason of the liability imposed on you for bodily injury or death of a person or persons. That is the approximate legal phraseology. It means that the company agrees to reimburse you after judgment has been taken and the money collected from you. Obviously, the company cannot legally promise to pay you before the loss has been sustained.

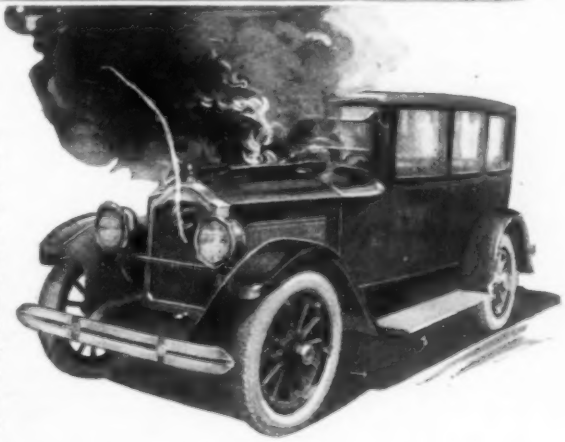
But some companies will let you pay the judgment, and if you can't pay, they refuse to settle, since you have suffered no loss, as yet. But the judgment remains hanging over your head ready to be levied on any future property you may acquire. Other, and responsible companies, voluntarily pay legal claims out of their coffers without forcing policy holders to sustain the loss first. It is important to be sure which kind of company you hold a policy in. If it is the first, you may have an accident and then find your home taken away from you to pay the judgment, after which the insurance company will reimburse you.

If you have a standard policy, it may include, and you may have failed to note, a clause relieving the company from liability while your car is towing or propelling any trailer or other vehicle. If you have a touring trailer or are in the habit of helping unfortunate motorists by giving them a tow, be sure the policy is amended in writing to cover the point.

Collision Insurance, if You Have No Deductability Clause, Will Cover Damage Done to a Spring When Your Car Strikes a Bump or Drops into a Rut, But Costs Considerably More



A Triple Crash in London; Either One of the Cars at the Right Might Be to Blame, a Nice Point in Fixing Damages; Fire Insurance Is Needed Often, But Is Cheap and Protects You against Accidents like That Below



If other members of the family or friends drive your car, you should be sure the policy covers any damage they may do to property or other persons. Most policies stipulate that the company's liability shall apply to you first, and then, if there is any balance of the liability left, it will apply toward judgments against your friend who was driving the car at the time of an accident. In other words, if you had $10,000 liability coverage and a jury rendered a joint verdict against the friend who was driving and you as owner of the car, and that verdict was for $8,000 each, your insurance company would pay your share, and apply the $2,000 remaining to your friend's share.

There is an interesting legal point involved here. If your friend drove the car at your request, he is acting as your agent and you are responsible for any damage he does. If he asked permission to drive the car, then he alone is responsible. But if your policy covers not only your liability but that of family and friends, then your insurance company will protect him up to the limit of the policy.

If your chauffeur or a garage employe takes your car out without your knowledge and has an accident, then your policy does not protect him, but does safeguard you.

On the other hand, if you send the car to the garage for repairs, and during the course of the work it is taken out by a garage mechanic for testing on the road, and he has an accident, the injured person has a good chance of getting a verdict against you, particularly if you have money and the garage employe or owner has not. In this case your insurance policy will be absolutely worthless unless you have made sure that it does not contain a clause disclaiming liability in event of any accident incurred while demonstrating or testing the car.

There are even jokers in the theft policies. In large cities, it is common in standard policies to class spare tires, spotlights, motometers and other easily removed accessories with the tools and repair equipment, and refuse to insure them against theft, unless they are stolen along with the entire car.

But suppose a thief tries to steal your car, pushes it around the corner, is un-

able to get it started, and then steals the spare tire. You present a damage claim for loss of the tire, but the insurance company may deny it, on the ground that you still have the car. Unless you get the thief and have him admit he tried to steal the entire car, there is not much chance of collecting.

Few autoists know that their insurance policy will cover injuries sustained by members of their own families, suffered while the insured is driving the car. Yet a jury in a New Jersey court recently awarded a verdict of $800 to a girl whose nose had been broken while she was riding in the automobile driven by her father. To fix the liability of the insurance company, the girl brought suit, naming her father as defendant and charged him with reckless driving. The jurors decided she had proven her case and awarded the verdict, which was against the father, but came under his insurance policy, so the insurance company had to pay.

In a similar case in New York, a mother, as next friend to their minor child, brought suit against her husband, alleging that the father told the boy to wait for him on the running board of the car, and then returned, jumped in and started to drive off, forgetting about the boy, who was thrown to the street and injured. The suit was just a friendly one simply to determine the amount the insurance company should pay.

In both these cases the owner of the car carried adequate insurance, but there is always the possibility that an uninsured autoist may some day face the same situation, have a jury decide against him, and have to pay the indemnity out of his own pocket.

Damages awarded by juries, as has been pointed out, show a constant tendency to increase. Death cases where $5,000 to $10,000 insurance once offered adequate protection, now are settled with verdicts for anywhere from $15,000 to $50,000, or even more. When you buy liability insurance, it is well to learn the temper of juries in your vicinity and see what size damages have been awarded.

This is only a bare outline of some of the things that may happen to you if you don't read your auto-insurance policy, and read it until you understand every phrase. There are plenty more, and if you ask a friend who has had an accident, he probably can tell you some of them from personal and sad experience.

If You Drive in Heavy Traffic, Are a Poor Driver, or Are among Other Poor Drivers, the More Accident Insurance You Carry the Better; a Street Car or Truck May Do This to You Any Day

FISH AND WHALES ARE LABELED TO TRACE MOVEMENTS

To find out how long whales live, how far they travel, and other facts concerning them, small identification darts are fired into the thick layer of blubber on the back of the monsters with a specially designed crossbow. Each dart has a label attached, and hunters, finding one of the tagged whales, report the legend on the marker, a record of which is kept at the British colonial office. This plan of identifying creatures of the sea is also applied to salmon, mackerel and haddock. The fish are caught in a trawl net, and the best specimens are labeled with two disks, he.d together by silver wire, which is threaded either through the back fin or the hard lap covering the gill. The disks are marked with letters and numbers, and for the capture of each fish and the report of its marker, a reward is paid. By this means, it was found that one young plaice covered 210 miles in eight months, another 175 miles in three months. A salmon labeled in the spring of 1919 was three feet long and weighed thirteen pounds. Recaught the next autumn, it had doubled in weight and had grown six inches in length. Even crabs travel long distances. One was found 100 miles from the place where it had been tagged.

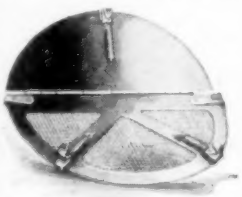
GIANT HORSES CARVED IN STONE FOR KING'S MEMORIAL

Details of the monument in honor of King Victor Emanuel II in Rome include the figures of enormous horses which were carved in sections and put in place with tackle because their huge size forbade shaping them as a single unit. Although the replicas are not intended for close scrutiny, they are accurately and carefully fashioned.

Carving Horse's Head, One of the Details of Huge Monument to King Victor Emanuel II in Rome

FOLDING LID FOR CAMP BUCKET FITS IN GRIP

Fastened with strong spring clips and fitted with a screen strainer on one side, a folding top for the camp bucket can be carried inside the grip or tucked away in almost any small space. It is made of galvanized steel and is adaptable to many uses, as on a minnow pail, a lid for the cooking pot—the screen permits easy draining—or a cover for the water bucket. One side of the top can be raised to permit the use of a cup or dipper, and the screen holds back sticks and refuse in case the container is used for filling the automobile radiator.



MIRRORS AID TO SUN IN DRYING AND COLORING MACARONI

By using mirrors to supplement the sun in drying macaroni, manufacturers of the product have found the color to be more satisfactorily preserved, since the deep yellow tint is not bleached so easily, and the flavor also is said to be improved. The process is quicker than sun-bleaching.

ROLLERS HOLD WINDOW SASH WITHOUT WEIGHTS AND CORD

Windows are held at any desired level by a pair of rollers attached to an adjustable tension spring. They are set in the side of the sash and simplify installation, since no space is needed for weights and cord, and the frames can be placed against a brick wall if desired. The tension of the spring may be adjusted so that it will hold a heavy window as securely as a lighter one.

GROWTH OF CEMENT INDUSTRY SPURRED BY PAVING

The United States now produces more Portland cement than all the rest of the world combined, government figures show, and the rapid growth of the industry is seen in the increase of shipments. In 1914, the total amount was 86,437,956 barrels, while the estimated shipments for last year were 145,747,000 barrels. Nearly twenty-five per cent of this total was consumed in paving and road building. In eight years, the demand for cement for road purposes alone has increased more than 400 per cent.

WOOL MUDGUARDS FOR ANKLES PROTECT AGAINST SPLASHES

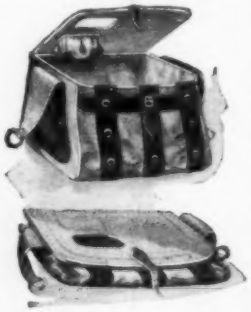
To shield the stockings from mud splashed by automobiles in wet weather, women are wearing gaiterlike protectors of wool. They fit tightly about the ankles, are easily removed or put on, prevent damage to fabrics, and afford comfort in cold weather.

COLLEGE HAS "TIN-PAN ALLEY" TO TEST GALVANIZED WORK

Steel articles that have been coated with zinc, cadmium, lead, nickel and other metals through different galvanizing processes are to be left out in the open for an indefinite period, possibly thirty years, at Pennsylvania state college, to test the ability of the objects to resist corrosion. The experiment ground has been called "Tin-Pan Alley" and the "Acre of Metal." A wide variety of specimens has been selected for the time and weather test, including drinking cups and sheet roofing.

FOLDING BAG FOR FISHERMEN FITS IN SUITCASE

Fishermen are spared the trouble of extra luggage by a folding creel that fits flat when collapsed, so that it can be carried in a suitcase, is easily strapped to the saddle or may be tucked under the automobile seat cushion. It is made of waterproof duck which has been treated to prevent mildewing, is bound with leather and rubber-lined. There are no rods to adjust, ventilating holes are provided, and a pocket for bait is arranged in the top.



WAYS TO IMPROVE BEDS SOUGHT BY STUDYING SLEEPERS

While twelve young men students at two eastern schools slept in specially prepared cots, scientists each night studied their movements to learn the effects produced by different types of beds and bedding, and the relation between fatigue or various mental conditions and sleep. A recording apparatus was attached to each bunk for registering the degree and time of movement of its occupant, to indicate periods when there was not complete relaxation. Another instrument gauged the mental alertness of the subjects, their degree of tiredness or efficiency. The experiments are to be conducted over a long period, possibly for several years, to obtain facts from which reliable conclusions may be drawn, so that better conditions for sleep may be achieved.

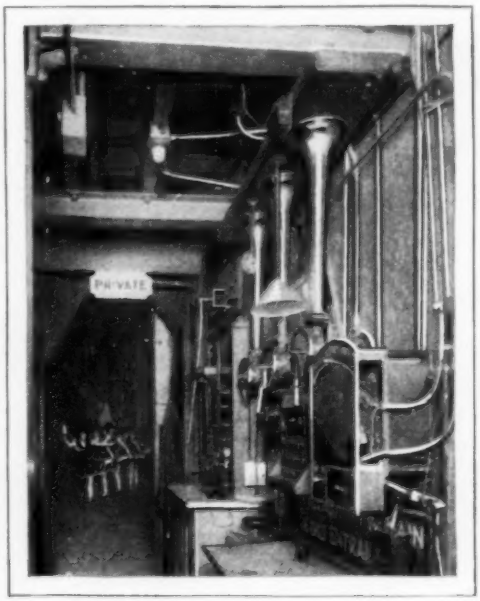
By HAROLD T. WILKINS

ELIMINATING massive scenery which cost more than $20,000 for a single set, a new electrical effect achieved by the Paris opera has made possible a far more realistic scene, with no equipment beyond a simple white sheet, made transparent by glycerin, and a battery of light projectors. The first sceneryless scene attempted showed the rush of the messengers of Odin in Wagner's "The Ride of the Valkyries."

The success of the experiment added another credit for the stage electrician, who is fast becoming the most important man back stage. The old equipment of footlights and an occasional spotlight has been replaced by huge installations, such as that at Drury Lane theater, London, which uses between seven and eight thousand lamps, ranging from individual colored globes to huge searchlights and mammoth "sun" arcs, consuming one hundred amperes each.

The master electrician who controls the enormous back-stage switchboard and achieves the lighting effects that make modern spectacular dramas possible must not only know his lights, but know the play as well as the man who wrote it. An opera-house electrician is required to know every note of the score of every opera produced just as well as the director of the orchestra. With his own copy before him on the music rack, the electrician plays the opera through in lighting effects, moving the multitude of switches in accordance with his penciled notes on the sheets of music.

The old-fashioned equipment for the valkyries' ride in the Wagner opera required several tons of properties, including a tremendous assemblage of tower-



What the Stage Manager Sees from His Corner—a Glimpse of a Rehearsal

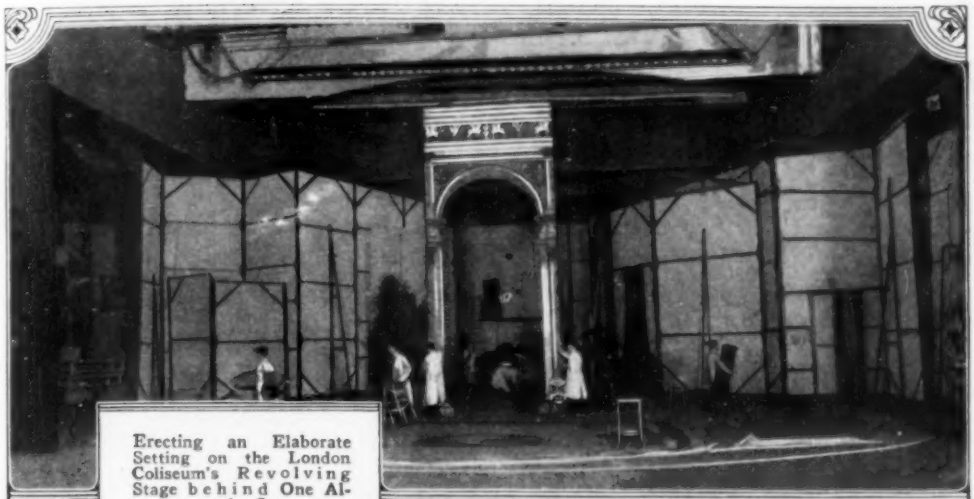
In the Scenery Studio Where a Wide Range of Settings Are Constructed and Painted

ing mountains and fantastic properties, with the movable specters mounted on iron rails. As played by electricity, the scene uses a few glass slides, three projectors and the white curtain at the back of the stage. The singers on the stage are illuminated by spotlights in the wings, instead of footlights, so their shadows will not be cast on the transparent back drop. The valkyries themselves are painted on one set of glass slides, the background on another and the sky on a third. Sky and background move across the transparent sheet in opposite directions, while the valkyries, appearing very small near one corner, grow larger and larger as the projecting focus is changed, and at the same time move toward the center of the sheet, until they appear to fairly leap out of it. The projectors are located behind the scene, throwing the light through it, just the reverse of movie projection.

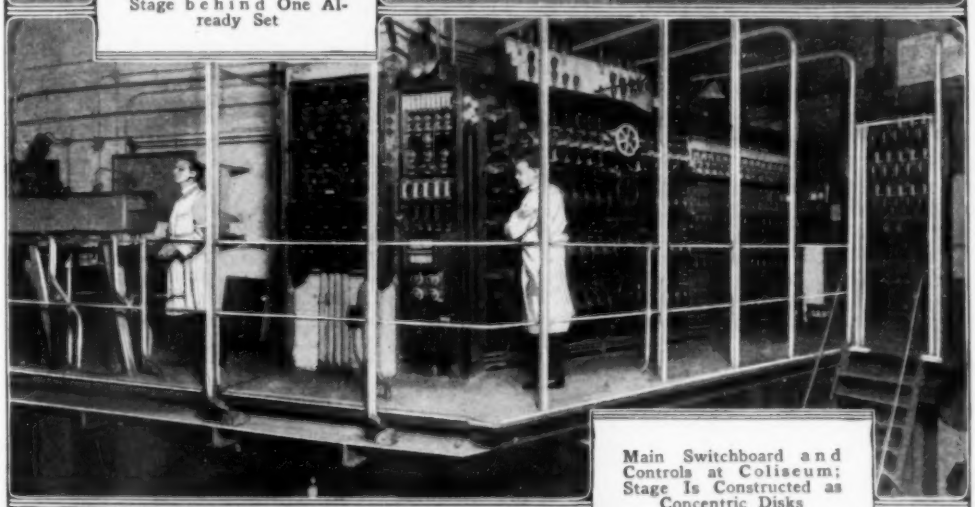
The stage effects used in a spectacular production such as those featured at Drury Lane consume an enormous amount of electricity. A single scene from "Decameron Nights," one of the big spectacles, used 184 big 500-candlepower lights just to illuminate the set, in addition to all the special lights which produced various effects. Back stage there are two huge switchboards, one in a fixed balcony, where the master electrician presides, and the other movable so that it can be placed at any desired point in the wings. Each battery of lights is controlled by a separate switch, with twelve positions, giving as many gradations from full light down through various shades of dimness until the current is shut off.

In the Boccacio presentation of Damascene splendor, a huge company of crusading knights in glittering armor, swords at their sides and with the cross of the crusades blazoned on each breast, gather with tonsured monks in the vast nave of a Gothic cathedral setting. They face the high altar and, to the tones of a huge organ, chant the solemn Gregorian music of the Middle Ages. As the chant dies away the artificial sunbeams, pouring down in

Property Room and Some of the Craftsmen Who Construct Materials for Special Scenes; Their "Stock" Ranges from Frescoes for Egyptian Tombs to Children's Gocarts



Erecting an Elaborate Setting on the London Coliseum's Revolving Stage behind One Already Set



Main Switchboard and Controls at Coliseum; Stage Is Constructed as Concentric Disks

Track and Apparatus beneath Revolving Stage, 225 Feet in Circumference and Seventy-Five in Diameter

dancing streams through stained-glass windows, pale and the knights file out, bound for the gates of Jerusalem. The picture slowly dissolves as the lights in the cathedral grow faint.

Again the curtain rises and the audience is transported to the Bridge of Sighs, watching through the colonnades as the gondoliers dreamily glide down the canals of Venice, singing their boating songs. Again the magic carpet of lighting changes, and the spectators see the hanging gardens of Damascus, then enter the palace of the Soldan, with its baroque splendors of Oriental light and color, picturesque eastern mobs and bevies of dancing girls in voluptuous seraglios. The climax comes when the whole company descends, in front of the audience, a staircase leading down behind the footlights, the Soldan of Egypt resting on the shoulders of his attendants, and behind him Saladin, Prince of Damascus.

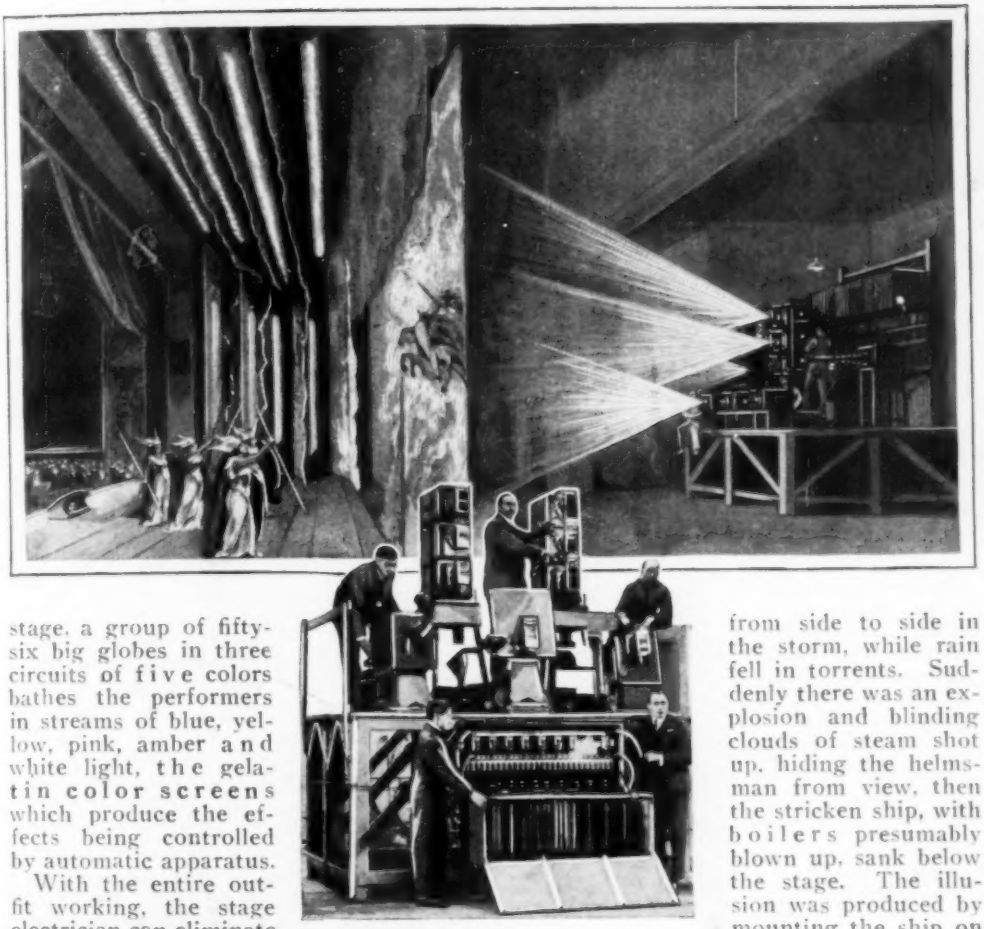
Back stage, in wings and galleries rising nearly 100 feet above the stage, and below the scene in hidden pits, a small army of unseen workers have carried the scenes through. Even the descending staircase, where none had been before, was manufactured in a twinkling by engineers so far removed from the stage that they were directed by flashing electric lights and could only see the stairs take form by watching their gauges which reflected the movement.

Hanging from the walls of the wings, and stretching across stage far above the proscenium arch are row on row of lighting bridges, lined with big lights and banks of small ones. Huge panorama lights, with seven ranges of colors and thirty-six 2,000-candlepower sun arcs, which can be slowly dimmed or strengthened, give realistic sunrise or sunset effects. Ten banks, each containing 260 forty-watt globes, with three color circuits, sweep waves of color across the actors and scenery as desired. Down from the high lighting galleries in the wings an even dozen white lights, of 24,000 candlepower, cast brilliant light over the stage. Another battery of these 2,000-candlepower globes is spread along the front of the stage, just before the footlights, to paint out shadows which may be cast by the lights from above.

On either side of the stage, five horizon lights, also of 2,000-candlepower each, chase the shadows from the tops of towering scenery, or sweep across the stage level. And if even more and whiter light is desired, there are batteries of oxygen tanks and gas containers ready to illuminate groups of big limelights, capable of throwing the mountain peaks or castle turrets of spectacular scnes into high relief.

The color lighting of iridescent costumes is controlled by a group of high-power arc lamps and an extra battery of twenty-four limelights. On either side the

Interior of the London Coliseum; with Its Tiers of Luxurious Seats and Artistic Lighting, the Modern Theater Auditorium Is Planned to Harmonize with Its Stage



Courtesy Eugene Frey, Paris

Projector and Screen That Replace a Complicated Set in an Opera Act

stage, a group of fifty-six big globes in three circuits of five colors bathes the performers in streams of blue, yellow, pink, amber and white light, the gelatin color screens which produce the effects being controlled by automatic apparatus.

With the entire outfit working, the stage electrician can eliminate most of the hanging cloths and painted friezes used in the past to represent sky and clouds, along with the lights which formerly illuminated them. The illusion of sky and horizon, cloud and tempest, rain and sunshine is created entirely by cleverly focused lenses and white and colored lights, combined with photographic projection apparatus.

Even more unusual than the lighting arrangements, however, is the group of bridges which can be turned into a stairway, if desired, or used to produce a shipwreck at sea, a train wreck on land, or any other spectacular effect involving disappearance. Six sections of the floor are movable, two controlled by hydraulic lifts, two by electric motors, and two by handwheels and counterbalances.

In one Drury Lane spectacle, an ocean liner on the stage battled a terrific tempest. The ship rose and fell and rolled from side to side in the storm, while rain fell in torrents. Suddenly there was an explosion and blinding clouds of steam shot up, hiding the helmsman from view, then the stricken ship, with boilers presumably blown up, sank below the stage. The illusion was produced by mounting the ship on one of the hydraulic lift bridges, with a ball and socket joint by which it could be pitched and rolled in the seas. At a signal flashed by the electrician to the theater boiler room, the engineer opened a valve and shot a jet of steam through a flexible connection to the scenery on the stage, while at the same time a flash pan of powder was exploded. Then the hydraulic bridge was slowly lowered, carrying the ship with it.

In another production, a locomotive dashed onto the stage, a real whistle shrieked with real steam supplied by the same flexible tube, and the engine dashed over a parapet wall and plunged into the pit, a mass of smoking wreckage.

Like the vast batteries of lights, the bridges and other mechanical effects are all directed from the chief electrician's gallery. Watching the stage from his high vantage point, he sends each bridge operator his cue at the right moment.

South American Suspension Bridge, Five Hundred Feet Long, Is Tied Together Wholly with Knots, No Nails Being Used

BRIDGE BUILT WITHOUT NAILS IS TIED WITH KNOTS

With a span of 522 feet, a suspension bridge over the Rio Uribante near San Cristobal, Venezuela, contains no nails, bolts, screws or rivets, but is held together entirely by a special system of tying the natives use. The superstructure is of wood and is hung by long cables from uprights on either side of the stream. Besides being strong and durable, the bridge has a neat appearance, rivaling that of steel structures of similar types.

FUEL GAS GENERATED AT HOME IN CHARCOAL BURNER

Gas for cooking, heating water or warming the house may be generated at home in a small plant that uses charcoal. The apparatus requires no attention except to fill the hopper with a sack of fuel once each day and remove a small quantity of ash. Gas is derived from air and water vapor passed over the glowing charcoal by a small electric suction fan. It is not stored but is used as made and the supply is easily regulated by adjusting the burners.

Home Gas Generator Complete; Inverted Bag of Charcoal Fuel on Hopper of Main Unit

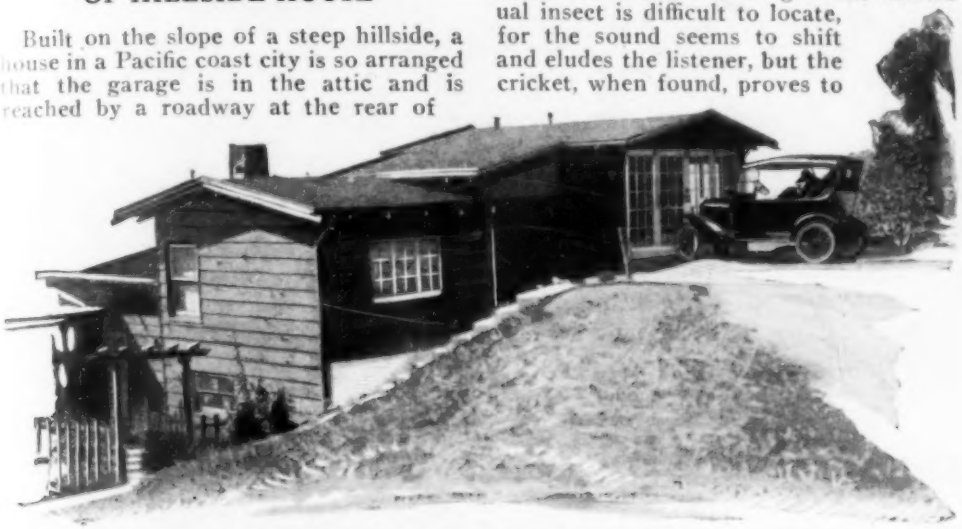
Germany is developing an artificial wool which is produced from pine wood.

HOW FOREIGN MAIL IS GUIDED TO PROPER ADDRESS

Due to the skill of handwriting and language experts of the post office department, only a small percentage of the thousands of letters annually received from foreign countries fail to reach their destinations. A day's mail at the Washington office, for instance, will include missives written in Pali from Baluchistan; in Hindustani from Burma, or in Senegalese from the Orange Free States. One from Perak, Federated Malay States, written by an Eurasian, falls upon the clerk's desk. The address extends from the upper left-hand corner diagonally to the lower right-hand corner. To the layman, it is a puzzle, but the translator ponders a moment, then writes the English equivalent of the strange characters below the foreign address for the guidance of the postman. One of the important duties of these special clerks is re-addressing mail directed to places in countries that no longer exist, such as Prague and Trieste. Constantly changing boundaries in such regions as the Balkan states and others, demand that the post-office workers keep abreast with the times. Where boundaries are still in doubt, the mail is sent to the most probable distribution point. By long experience, these expert clerks acquire an extensive knowledge of towns, cities and streets the world over. Without consulting a directory, they know that a letter addressed to Ovid is probably meant for New York, although the state is not specified, and that Ponchatoula is in Louisiana, and so forth.

CAR IS PARKED IN THE ATTIC OF HILLSIDE HOUSE

Built on the slope of a steep hillside, a house in a Pacific coast city is so arranged that the garage is in the attic and is reached by a roadway at the rear of the dwelling. The plan saved the cost of an extra building, which could have been erected only at considerable expense because of the location.



Auto at Door of Attic Garage, Which Is Built as Part of House on Steep Hillside; Steps Lead Down to First Floor of Dwelling

INSECTS DON'T SING, MUSIC IS OF INSTRUMENTAL TYPE

While the sounds made by various insects are familiar to almost everyone, not many know just how the tones are produced, and even scientists are perplexed as to the reason for their choruses. In a recent report from the Smithsonian Institution, it was pointed out that insects do not really sing at all, that is, produce tones by vocal cords. Their music originates from special organs most of which correspond to drums. The vibrations are set up by two general methods, by rubbing and by muscles attached to the vibratory surface. One species of grasshopper plays on two "fiddles" at a time; the strings are its front wings and the bows its hind legs. The katydid produces its peculiar sound by rubbing the file-like surface of its left wing over a ridge or scraper on its right, although the tone and volume of the notes are due in part to the vibration of the membrane on its wings. The musical organs of the cricket are like those of the katydid, except that the parts are equally developed on each wing. Their method of playing is generally the reverse of that of the katydid, the right wing being kept on top of the left. Tree crickets produce the ringing music frequently heard on summer evenings. An individual insect is difficult to locate, for the sound seems to shift and eludes the listener, but the cricket, when found, proves to be a slim-legged pale-green creature with hazy wings over its back. To produce the song, these are raised and rubbed together so rapidly that their outlines become almost invisible. The cicadas, popularly but inaccurately known as the locusts, have an oval membrane like the head of a drum, set into the solid rim of the body wall just back of the base of each wing. These membranes are set in vibration by muscles, and the sound is due to a cavity in the insect's abdomen.

INSULATED-WIRE CONNECTOR REPLACES TORCH AND TAPE

Insulated wires can be joined quickly and easily with a connector that requires no wrapping tape, torch or solder. It consists of an inner socket into which the wires to be connected are inserted after being twisted together. A screw is then placed in the jacket to hold the wires in place and a fiber cover slipped over it and the rest of the connector to provide insulation. The device is made in only one size and has a capacity of from two to eight stranded wires. It is handy for emergency jobs about the house.

One of the Six Blocks in the New South Water Market, Where Chicago Produce Dealers Handle All the Perishable Food Supplies for a Great City; Insert, Wheeling California Fruit into the Refrigeration Room of One of the Cement-and-Tile Store Units

Where Chicago Produce Dealers Handle All the Perishable Food Supplies for a Great City; Insert, Wheeling California Fruit into the Refrigeration Room of One of the Cement-and-Tile Store Units in the New South Water Market

Feeding a City of Three Million People

Every State Contributes the Fruit and Vegetables, Poultry, Butter, Eggs and Cheese Handled in World's Biggest Produce Market

HOW much garlic will it take to satisfy the appetite of the garlic eaters in a city of 3,000,000 people? The produce merchants of South Water street, who still retain the name of Chicago's historic market center though they have recently moved into a new $17,000,000 home some miles away, can tell you after one glance at their annual records.

The answer is twenty-seven carloads, or at least it was in 1924, and if you ask, they will give the additional information that California contributed twenty-four carloads, Louisiana two and Illinois one.

Twenty-seven huge railroad cars filled with the odorous bulb is enough to stagger the imagination, but that item was only a drop in the bucket in a produce-distributing center that handles a hundred thousand carloads of fruits and vegetables every year, along with 88,464,594 pounds of dressed poultry, 258,061,395 pounds of butter, 130,022,710 pounds of cheese and 4,679,295 cases of eggs.

Sunny Italy Is Well Represented among the Commission Men, Particularly Those Handling Fruits

The grand total is what Chicago ate in one year, and includes the perishable foods only, as South Water street does not deal in canned foods, nor does it handle any meat except poultry.

To clear the way for a new double-decked boulevard, and to get out of a

row of ramshackle old buildings that dated from just after the Chicago fire, the 166 produce dealers of this, the world's biggest produce market, built themselves their new seventeen-million-dollar home, which covers six city blocks and has railroad connections at the back-doors, eliminating a tremendous amount of unnecessary trucking.

Every store unit is fireproof and sanitary, made so by concrete-and-tile construction. They are equipped with vast refrigerating plants for the perishable goods, and heated rooms for the delicate fresh fruits and vegetables brought from southern states in winter. The streets between the buildings are wide, to

Samples of All the Smaller Vegetables and Table Delicacies Are on Display While the Dealer Exhibits a Box of Fresh Mushrooms; Insert, Stacking Western Grapes on the Sidewalk

handle the press of trucks and wagons which call each day from thousands of grocery stores and fruit dealers.

As famous in its way as Wall street or LaSalle street in the financial world, this unique food center started more than a hundred years ago with a trading post on the banks of the Chicago river, where the settlers exchanged their goods for supplies, principally game, brought in by friendly Indians. Until the move a short time ago to its new home, the entire produce business of the city had centered ever since in the street along the river.

From a trading post for Indians it grew until, in recent years, the annual turnover has reached half a billion dollars, putting it second to "Packingtown" among the city's industries.

In the early days the commission men of the street dealt in everything from hay and hides to vegetables and flour, and in winter, when there were no fresh fruits and vegetables arriving from warmer

Poultry Is Plucked and Dressed in Wholesale Quantities for Each Day's Market

Chickens Are Shipped Alive in Special Cars, Fattened and Killed as Needed

climes, as they do now, the street turned to meat, and invited the farmers for miles around to kill their hogs and send them in.

The versatile dealer in everything disappeared long ago, and in recent years each of the 166 commission houses has specialized in its own lines. The grocer's buyer gets his cases of oranges and lemons from California and grapefruit from Florida at one store, moves on and gets a supply of dressed poultry, butter and eggs from another, stops at a third for some cheese, and calls at a vegetable house for artichokes, asparagus, beans, brussels sprouts, cauliflower, carrots, cucumbers and other supplies. Another firm will contribute cantaloupes and perhaps some fresh fruits or berries in season, and so on, until the day's supplies for the store have been collected. Less than a hundred dollars will cover the cost of a wagonload for the average grocer, but the total purchases of the thousands of city stores in a year will exceed $500,000,000.

The vast sum this single city spends for food each year goes back to the farmers scattered through every one of the forty-eight states. Some of the items come from only one or two states, and others from several. California is the sole source of the thirty-three carloads of apricots, required to satisfy the city's annual appetite, while thirty-seven states, ranging from New England on the east to Montana, Idaho and Wyoming on the west, contribute toward the more than 130,000,000 pounds of cheese. California, again, sent a thousand and one carloads of lemons in 1924, but with four cars of potatoes was only one of thirty-five states contributing toward the 22,356 carloads consumed. Wisconsin alone supplied more than 7,000 of those cars, and Minnesota ran second with nearly 5,000 carloads.

Washington led the apple-growing states, contributing more than 3,600 of the 9,242 cars received. Three states sent 177 carloads of asparagus, while California again stood alone as contributor of ninety cars of artichokes. The progress of the

In Fair Weather the Entire Store Fronts Roll Back

Sidewalks, under the Canopy, Are Clogged with Boxes

Insert, Grocers Loading Their Purchases into Their Trucks, in Order to Clear the Sidewalk for the Next Wagon in Line

The "Street" Has Its Own Bank in One of the Stores, Sandwiched between a Fruit Dealer and a Vegetable Man

seasons can be watched by the arriving cars of some of the year-around staples. Florida, Mississippi, Alabama, Louisiana, Texas and California send in the first beans of the year; then, as spring advances, Arkansas and North Carolina arrivals appear, to be followed by Illinois, Missouri and Maryland. These eleven states raised 109 cars of wax and green beans for the people of Chicago in 1924.

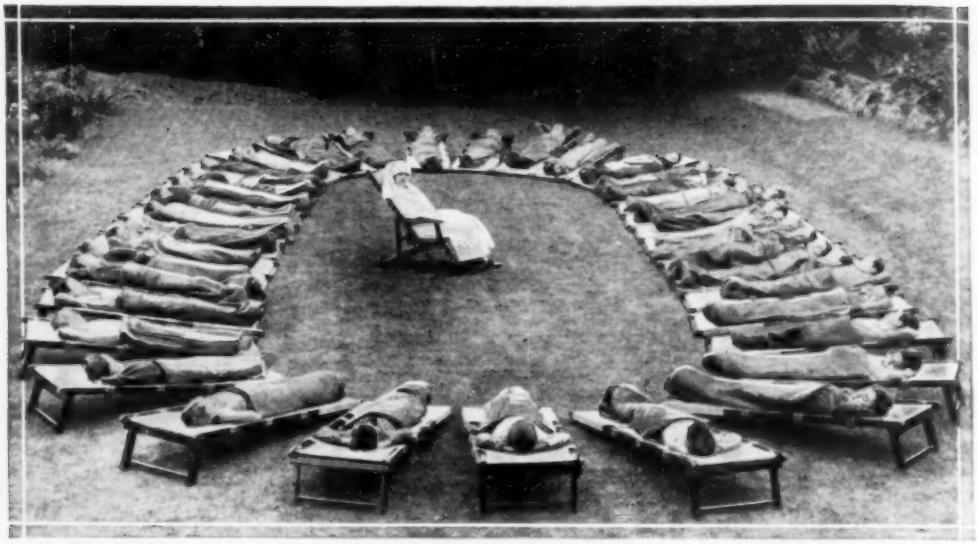
The summer berry crop is spread over much of the middle west, and stretches into other sections. Wisconsin and Michigan contributed twenty-six cars of blueberries, while Michigan, Arkansas, Tennessee and North Carolina gave twenty-eight cars of blackberries. Two states sold twelve carloads of currants to South Water street; twenty-three states sent 2,675 cars of peaches; some of the same sections supplied 1,574 cars of pears, and others, including many in the south, grew 2,356 cars of strawberries for this one city.

The street handles just fifty-seven varieties of produce, starting with the "A" of apples and ending at "W" with 3,100 carloads of watermelons. A study of the complete list, by states, is a lesson in the geographical distribution of American agriculture. Where do the gooseberries for gooseberry pie come from? A glance at the list shows Michigan was the sole state of origin of the fourteen carloads used in one year. The figures, however, do not show how many pies fourteen cars of berries would make, but the answer, in the words of one gooseberry dealer, is "plenty."

Some states contribute to more than half of the fifty-seven different kinds of food. Illinois alone supplies portions of the supplies of thirty-three different articles, New York produces twenty-three, and California, which leads because of its citrus and other fruits, contributes forty different articles.

WATERPROOF SANDPAPER

Waterproof sandpaper, now on the market, permits use of the abrasive under damp or even wet conditions, and prevents raising dust when cleaning painted, varnished or enameled surfaces. Both sides have been treated and the gritty material does not readily come off so that the paper is said to last ten times as long as the ordinary product.



A "Circle of Health" to Cure Lung and Throat Ills; Children Taking Fresh-Air Treatment Enjoy Rest Periods on Special Cots That Protect Them from Dampness

CHILDREN'S CIRCLE OF HEALTH RELIEVES CITY ILLS

Fresh-air treatment has been found beneficial to London children who are exposed to its fog-laden atmosphere, and one of the aids to the health authorities is a special type of cot upon which the patients can recline out of doors while resting and, at the same time, be protected from cold and dampness. The beds are easily set up or taken down, strong and comfortable, and prevent exposure to moist grass or earth. By arranging a number of the cots in a circle, a single nurse can watch over many children at a time. They are taught uniform methods of reclining and the best positions to assume, as an additional aid to health.

BLACKSMITH SHOPS STILL BUSY DESPITE THE AUTOMOBILE

Although the clang of the anvil has been dulled by the exhaust of the motor, blacksmiths in this and foreign countries still do a thriving business. There are 175,000 men in the occupation in the United States today, according to statistics gathered on the industry. The total yearly output of horseshoes is estimated at 1,250,000 hundred-pound kegs. A peak year was registered in 1918, when the product was valued at $12,000,000, due largely to the demand occasioned by the World War. Approximately 17,000,000 mules and horses are employed in agricultural work in the United States and many of these need the blacksmith's attention. The industry has been known for more than 2,500 years and the methods of horseshoeing have not changed greatly since the days of the early settlers and of Longfellow's "Village Smithy."

LEVER BATTERY-POST CUTTER LEAVES STRAIGHT EDGE

Fitted with long arms and toggle action so that strong leverage may be developed, a battery-post cutter shaves off the lead flush with the hood plate. It has interchangeable knives and after the cutting is done, leaves a straight, smooth edge.

LEVEL WITH CONSTANT BUBBLE AIDS ACCURATE SURVEYS

Changes in temperature, affecting the length of the air bubble in the spirit level on a surveying instrument, sometimes interfere with accurate observations. This difficulty is reported to have been overcome in a level with a tube so shaped that only the cross-sectional area of the bubble is affected, the length remaining unaltered.

WHY SEA IS BLUE

Small particles of salt in the sea explain why the ocean often appears to be a deeper shade of blue than fresh water, according to one theory. The color deepens according to the depth of the water and the amount of salt. For instance, the Mediterranean, noted for its beauty, is rich in the mineral and the Pacific ocean sometimes appears dark enough to be called indigo. Stretches of white sand below shallows near shores cause the blue to change to different shades of green or gray, and myriads of minute organisms in some parts of the seas affect their color. Blue is the fundamental color of water, although it cannot be detected in small quantities of the liquid. The sky's color is believed to be due to minute particles of dust in the air and the way in which the sunlight is reflected by them.

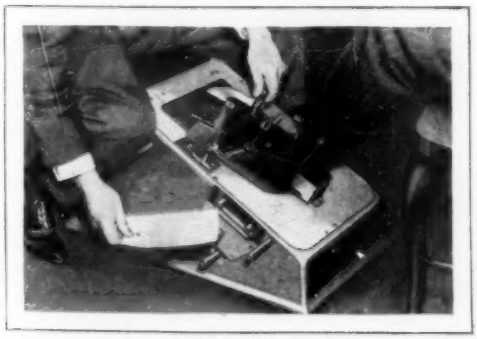
Sliding Ring Anchor to Which Worker's Belt Is Buckled as Safety Precaution While Painting Pipe

LIFE BELTS PROTECT PAINTERS FROM SERIOUS FALLS

Painters and other workmen at a large manufacturing plant who are required to climb to perilous positions, are guarded by specially constructed life belts about the waist and attached to the structure on which they are engaged. In painting a large horizontal pipe, the life lines were connected to a ring encircling the conduit, so that it could be moved along as the work progressed. Even the paint pail had its "life line" to prevent danger to those below. Similar equipment was used by men on a scaffold to provide a safeguard if the rope falls should break.

SHOE FITTER MEASURES FOOT AND STAMPS SIZE ON CARD

Measurements of the foot are taken quickly and accurately on a shoe-fitting apparatus to help the salesman pick out the right size for the customer without the bother of a number of trials. On a card inserted below the rest for the foot, numbers are automatically stamped, indicating the dimensions of the sole.



Instrument Records Dimensions of Foot on Blank

SUN LOSES FOUR MILLION TONS IN WEIGHT EVERY SECOND

According to estimates made by Sir Oliver Lodge, the sun loses 4,000,000 tons in weight every time the clock ticks. The scientist declares that this should occasion no alarm, however, for the sun can go on reducing at this rate for hundreds of years and still furnish the earth heat and light. The loss is represented in burning gases, the nature of which is to be studied further when an eclipse occurs.

The Gay Lion Farm and a Porcelain Statue of "Numa," Which Guards the Entrance; in Center Is a Group of Sixteen of the Fully Grown and Trained Beasts in a Corner of the Wire-Net Inclosed Yard in Which They Live, Instead of Being Caged in Separate Homes; Below, Mrs. Charles Gay and Three of the Cubs; Notice the Kittenlike Posture of the One Lying On Its Back; There Is a Growing Demand for Small Lion Cubs among People Who Want Unusual Pets

Mr. and Mrs. Charles Gay and a Group of Their Lion Cubs

Home-Grown Lions on California Farm

Eighty Animals, Raised on Goat's Milk and Trained without Whips, Gambol in Movies as Playmates of Actors

By FRED GILMAN JOPP

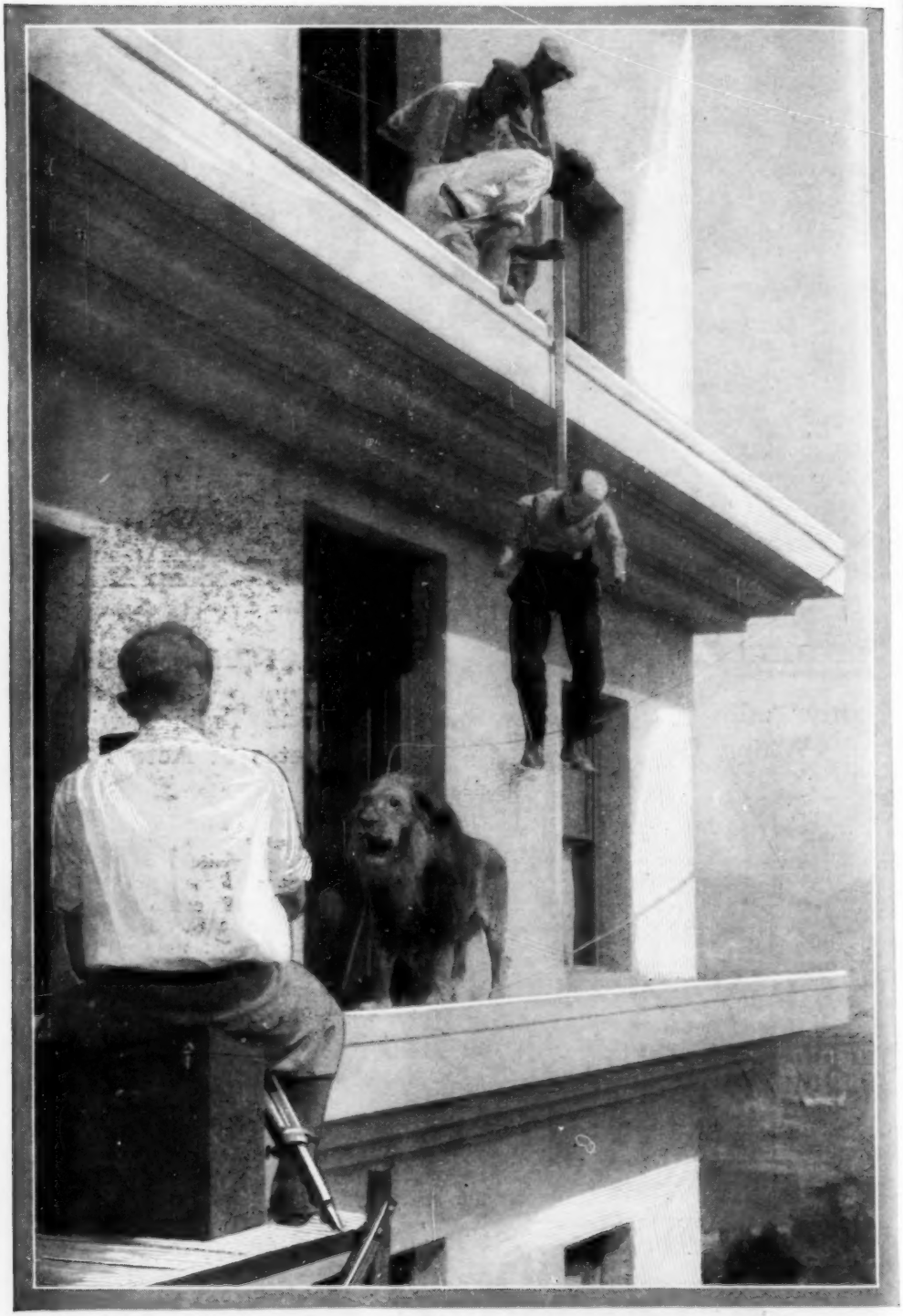
A FIVE-ACRE lion farm, with an annual profit per acre from each year's crop that would astonish more prosaic farmers, has, in the last six years, grown up as one of America's strangest business ventures.

Starting with a lion and two lionesses a half dozen years ago, Charles Gay, the world's only lion farmer, has run his shoestring into a $100,000 plant, a stock of eighty animals in addition to many which have been sold outright, and a business that pays a comfortable small fortune every year. A few years ago, he landed in Los Angeles with his wife, and ten dollars in his pocket, his only other asset a decade as an animal trainer in the Bostock troupe in Europe.

Today his lions are performing regularly in most of the movie studios of Hollywood, or in the imitation African jungle which he has planted on his farm. Each lion used in a picture draws a salary of $50 a day. In addition to this income, surplus stock is sold each year to zoos, circuses and stage performers, while hundreds of visitors daily pay admission to the farm to see more lions than eight or ten large zoos could boast.

The success of the Gay lions as performers is due to his unique training methods. The animals are as tame as kittens, even when full-grown and, under Gay's direction, can be handled by the most inexperienced movie actor without danger. They have never known a whip, prodding iron or blank cartridge, so are without fear of man. In their training, Gay uses a little switch, twelve inches long, and when he enters a cage full of the beasts there are no attendants outside with other weapons to protect him.

In addition to the professional market, there is a growing demand for cubs as pets. A cub at birth is valued at $350, so the pet market alone offers a good income for a farm which produces scores of cubs every year. Gay estimates the entire lion market of the United States can absorb 200 animals a year, and it is his ambition



Playing "Opposite" the Studio Dummy, the Well-Trained Lion Actor, like His Human Companions of the Screen, Faces the Camera for a Close-Up, Unmindful of the Perils of a High Cornice

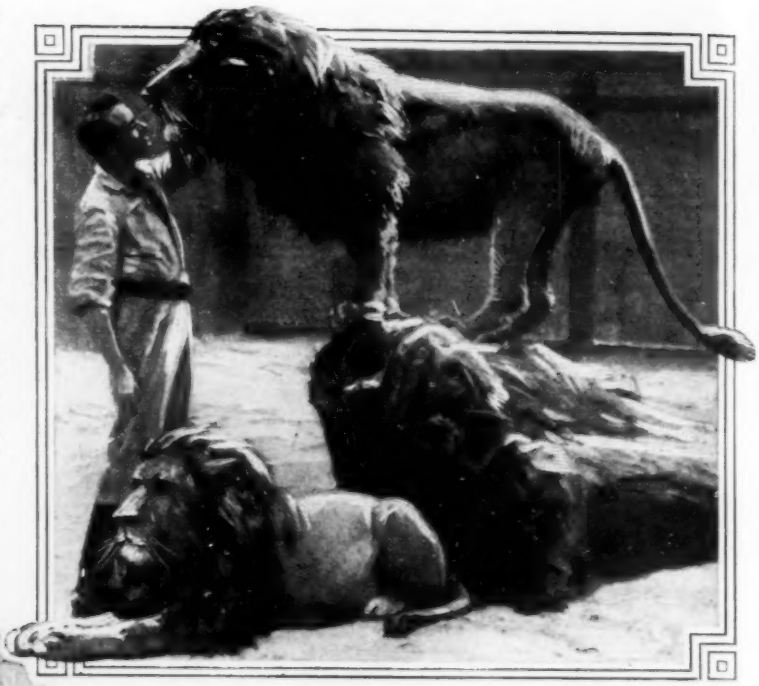
to supply it with tame farm-raised pets, eliminating the importation of half-savage beasts trapped in Africa. Full-grown and trained lions bring from $30,000 to $50,000, and a trained lioness, lacking the noble head and vast mane of her mate, not quite so much. "Numa," king of the Gay lions, is valued at $50,000 and is much in demand with photographers and painters as the most perfect lion in America.

There are no iron-barred cages on the lion farm. Instead, all the animals live in the open, roaming around in large screened inclosures. Heavy posts support the strongest wire netting, the bottom edge of which runs underground and is turned in for several feet to discourage digging out. Bordering the arenas, low stucco houses, divided into individual compartments, one for each lion, provide shelter. One arena is given over to the fully grown and trained animals, a second to the "high-school gang" of half-grown beasts, and a third is alive with a squirming, rollicking mass of cubs.

Each animal, from birth, has his own name, and for Mr. and Mrs. Gay his own peculiarities. "Numa"

Gay Taking a Ride on a Full-Grown Lion and an Actor Supporting Part of "Numa's" 600 Pounds

and some of the other patriarchs of the group are aloof, calm, sedate and dignified. "Pluto" and "Vanredi," the friendliest of the lot, are lively and playful. "Pluto," with his big paws well padded, is an expert at wrestling and boxing with his trainer. At three years of age he weighed 400 pounds and stood eight feet tall when he reared up on his hind feet. "Vanredi" is a purring, affectionate, but terribly lazy female; "Rosie," one of her sisters, is famous as the mother of quadruplets, something almost unknown in lion circles.



Gay Putting Two of His Big Performers through Their Paces in Drill

The cubs of the nursery class look like house cats and are as playful as any kitten. They are Mrs. Gay's special charge. At birth, they are removed from their mothers, for a lioness in captivity is helpless, apparently losing all instinct of what to do for her cubs. Mrs. Gay puts them in warm boxes in the sun and feeds them goat's milk

Another Argument against Wearing Trains, at Least When Lions Are Around

© Mack Sennett

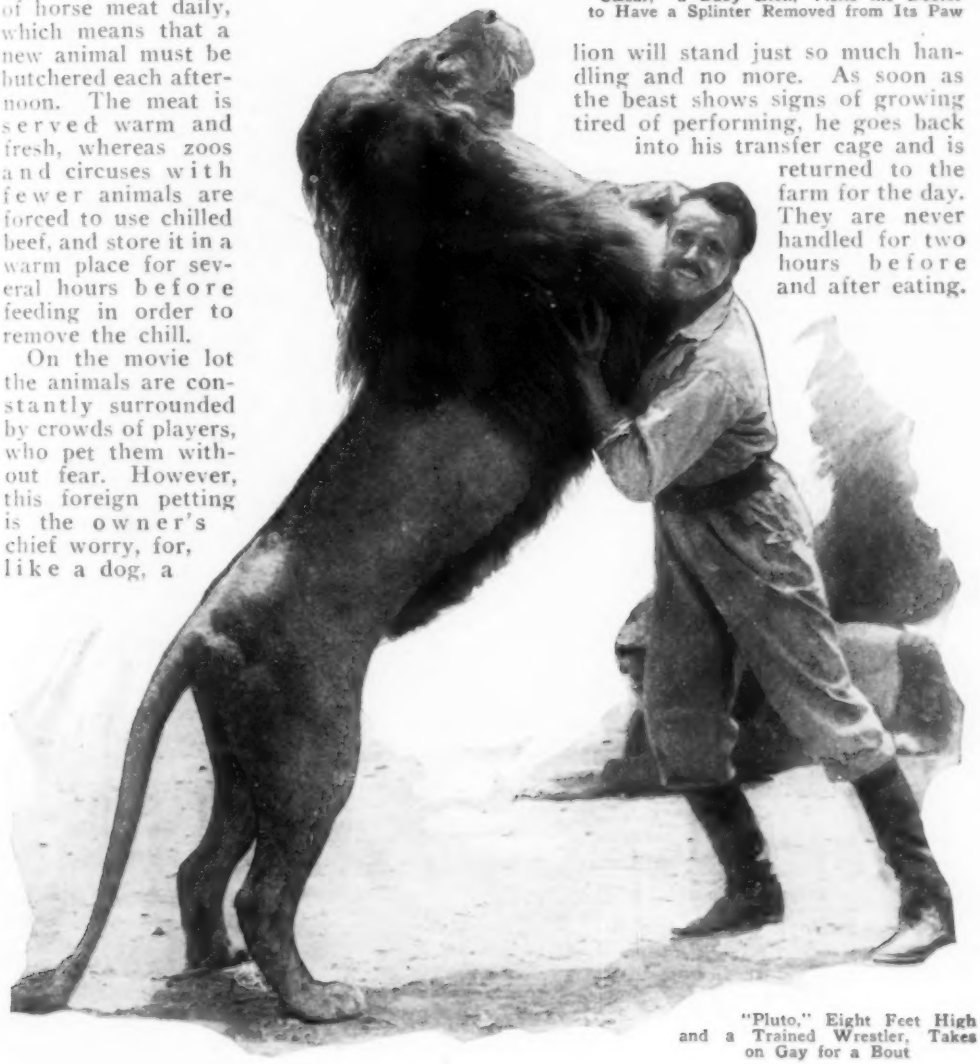
from a bottle three times a day. Later fresh eggs are added to the diet at frequent intervals.

As soon as the cubs are big enough to be weaned, they are turned over to Gay in the high-school arena and go on a meat diet, getting one meal a day.

Feeding a farm crowded with lions is an expensive task. A full-grown beast gets fifteen pounds of horse meat daily, which means that a new animal must be butchered each afternoon. The meat is served warm and fresh, whereas zoos and circuses with fewer animals are forced to use chilled beef, and store it in a warm place for several hours before feeding in order to remove the chill.

On the movie lot the animals are constantly surrounded by crowds of players, who pet them without fear. However, this foreign petting is the owner's chief worry, for, like a dog, a lion will stand just so much handling and no more. As soon as the beast shows signs of growing tired of performing, he goes back into his transfer cage and is returned to the farm for the day. They are never handled for two hours before and after eating.

"Cæsar," a Baby Lion, Visits the Doctor to Have a Splinter Removed from Its Paw



"Pluto," Eight Feet High and a Trained Wrestler, Takes on Gay for a Bout

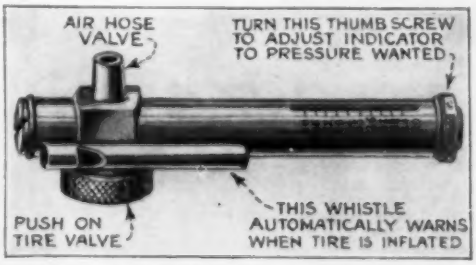
CHILDREN GUARDED ON STREETS BY LOWERING SAFETY GATE

Children have the right of way at times, while going to and from a school in Evanston, Ill., for automobiles are halted by gates similar to those used at railway crossings, permitting the pupils to reach the other side in safety. Juvenile traffic officers formerly were stationed at the intersections, but their signals were little heeded by motorists.

Striped Crossing Gate, like Those at Railroads, Is Lowered to Halt Autos, Insuring School Children's Safety

WHISTLING AUTO-TIRE GAUGE PREVENTS OVERINFLATION

Danger of overinflating auto tires is practically eliminated by using an automatic air gauge now on the market. Before attaching it, the motorist adjusts a thumbscrew indicator to the pressure desired. The instrument is then connected by inserting the tire valve into an opening in one side of the gauge and the hose into an aperture on the other side. When the required pressure is reached, the supply is automatically cut off from the tire and passes out through an "exhaust" valve while a little whistle blows to inform the user that the tire is properly inflated. The gauge is less than four inches long and is manufactured in two styles, one for balloon and the other for the ordinary high-pressure tires.


AIR HOSE VALVE
TURN THIS THUMB SCREW TO ADJUST INDICATOR TO PRESSURE WANTED
PUSH ON TIRE VALVE
THIS WHISTLE AUTOMATICALLY WARNS WHEN TIRE IS INFLATED

Safety Tire-Gauge Which Prevents Overinflation by Automatically Shutting Off Excess Air

AMERICAN RUSH IS CRAWL CITY SURVEY SHOWS

The pace of American cities is more of a crawl than a rush, if travel conditions in Washington, D. C., are typical of those in other centers. On the basis of 90,000 replies to a transportation-survey questionnaire, it was found that the pedestrian whose daily trips between his home and office are two miles or less, averages 3.7 miles an hour; street-car riders, 4.1 miles; motorbus patrons, 4.5 miles, and an automobile passenger, 5.7 miles. On journeys of two to six miles, 7.2 miles an hour was the average for street-car patrons, 7.5 miles for bus passengers, while 10.6 miles an hour was made by the private-automobile user. The survey also showed that the regular rider who uses the street car and pays in tokens at less than the cash fare, pays the companies 2.44 cents for each mile traveled; regular bus patrons 3.66 cents per passenger-mile, and the taxi rate is 23.9 cents for each passenger-mile. On the basis of an average load of 1.9 passengers, the cost of driving a private automobile is estimated at 5.85 cents per passenger-mile. Data relative to the amount of street space required showed that the private auto, on the basis of an average load, takes up forty-six square feet for each passenger as against ten square feet for each passenger on the street cars. In rush hours, the automobile requires fifty-one square feet of space to each occupant, as compared to seven for each street-car passenger. This difference is caused by the fact that autos carry fewer passengers during the busy hours, on the average, than the street cars. Although automobile owners were given previous warning that the count was to be taken, it was found that of the 85,000 registered cars, 18,000 were parked on the streets overnight.

How We Have Advanced Shown at Exhibit

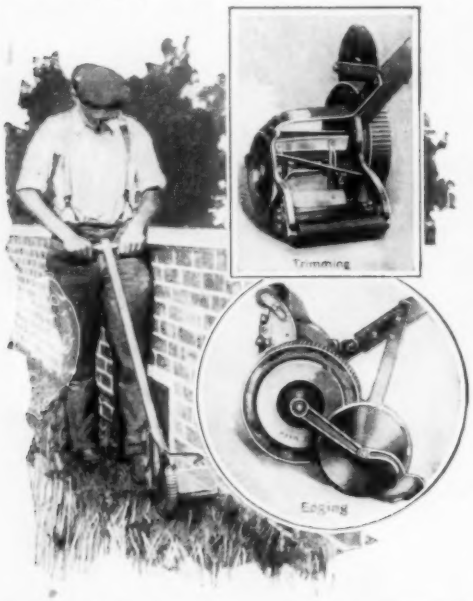
A Story of Progress Written in Iron — Household Appliances That Show Man's Endless Search for Comfort; Flatirons Above Are Typical of Those of the Fifteenth Century, and in the Center, the Young Woman Is Holding an Iron Found in the Ruins of Pompeii; It Was Intended for Use with Delicate Apparel

At Left of Center Is an Early Model of Automatic, Instantaneous Water Heater, the Forerunner of the Efficient Equipment of Today; Above, the Oldest Known Gas Range with Its Crude Oven and Burners, and at Left, Fireplace, Pots, Andirons and Other Accessories That Have Been in Service in the Same Family for 150 Years

Photos Copyright, Keystone View Co.

LAWN TRIMMER CUTS EDGES SAVING USE OF SHEARS

Owners of lawns are spared the task of trimming edges with shears or sickles by



Trimmer in Side and Rear Views and in Use Flush against a Wall

a mower that is like the ordinary kind cut in two. It can be run close against the sides of buildings, and not only cuts the grass, but slices the sod, evens up margins and cleans edges with a sharp disk that can be raised out of the way while cutting. Below the disk, is a little plowshare to throw material aside. The trimmer is similar to a full-size mower, having a four-knife cylinder.

HOW HIGH DO BIRDS FLY?

By applying methods of the astronomer, a German scientist has established reliable figures as to the height at which migrating birds fly. Formerly, many bird students believed that such elevations as 35,000 feet were not uncommon, but it is now practically acknowledged that the average height is only about 350 feet. The observer watches until he sees a flock of birds in flight across the face of the full moon. If he recognizes the species and knows their size, it is a simple matter of calculation to estimate closely their height by using the moon as a sort of scale. He has discovered thrushes flying at about 600 feet, starlings at 2,400 feet and lapwings at 2,200. The greatest height observed was 4,900 feet, but in this case the birds could not be identified. Assuming an average for their actual size, their apparent size as seen against a moon crater, gave the data for calculating the height.

BLIND MAN, GUIDED BY FINGERS, BUILDS OWN HOUSE

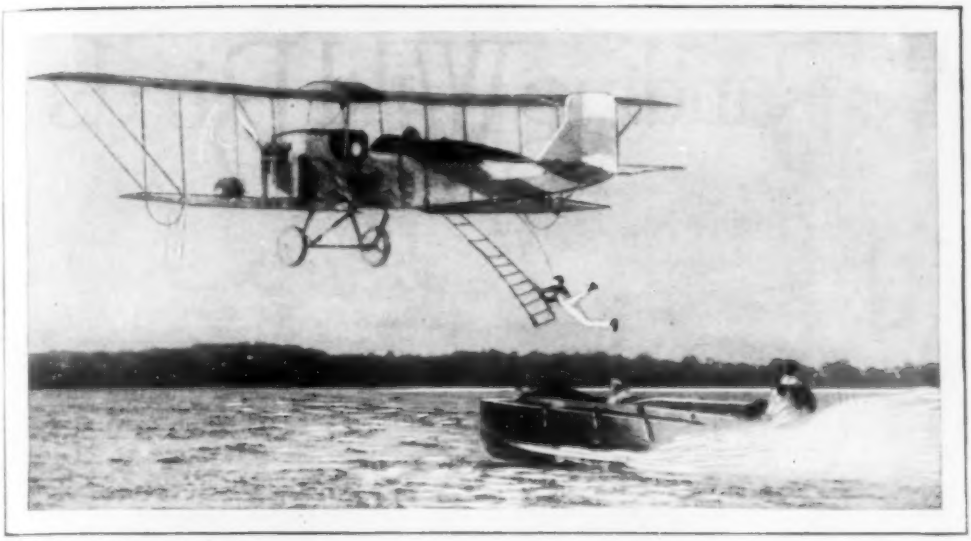
Although handicapped by blindness, Francis A. Burdett of Wayne, N. J., sixty-three years old, has built his own two-story house. His sensitive fingers served as his eyes to help him measure boards and timbers and fit them into place. The home is the second he has constructed. Three years ago he built a two-room bungalow, doing all the work himself and completing it in two months. He was a watchmaker by profession when an accident caused his blindness. He taught himself how to make crates and boxes and later applied his skill to home building.

AUTO WITH THREE WHEELS SEATS TWO PERSONS

Among the many types of small cars used in Europe, a three-wheeled auto with an all-aluminum body introduced in Berlin, carries two persons, one seated behind the other. Windshield, top, and adjustable headlight like those of the ordinary automobile are included in the equipment. The body is narrow, to decrease

"Tricycle" Automobile with Aluminum Body, Seats Two Persons Comfortably, One behind the Other, and Relieves Congestion

the amount of wind resistance, and a wide mudguard behind the front wheel protects the sides of the car.



© Henry Miller News Service

Stunt Man Leaping from Boat to Ladder of Airplane Going Eighty Miles an Hour; Later He Tried to Drop Back upon the Boat with a Parachute but Missed

LEAPS FROM BOAT TO AIRPLANE AT EIGHTY MILES AN HOUR

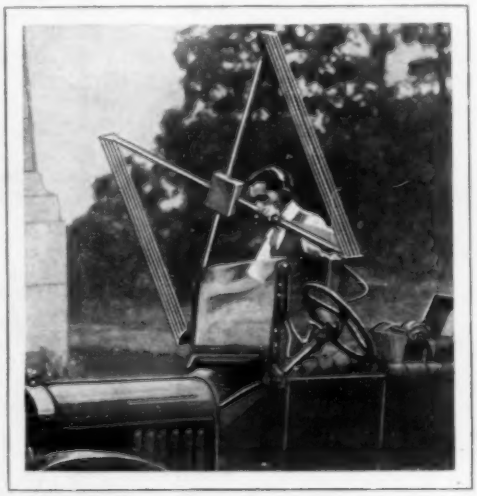
Teamwork and skill were required for the successful leap of a daring "stunt man" from a fast motorboat to an airplane. The boat was going sixty miles an hour when the plane, flying twenty miles an hour faster and with a ladder dangling, swooped down so the climber could catch on. The connection was made without mishap, and when the plane had ascended 1,800 feet, the man on the ladder attempted to leap back to the boat with a parachute. His calculations and those of the aviator and the hydroplane operator were so nearly correct that he missed his objective by but a few feet.

EXPERT GOLFER TEES OFF FROM GIRL'S HEAD

Standing 273 feet above the street on the twenty-fourth-floor level of a Chicago office building, a professional golfer made a drive of 781 yards. Besides this stunt, the player demonstrated his skill by driving woolen balls from a cardboard tee placed on the foreheads of assistants, one of whom was a girl.

RADIO DEVELOPS A DETECTIVE TO LOCATE INTERFERENCE

The radio industry has given birth to a special kind of detective, a sleuth not concerned with evidence relating to crimes but to causes of interference, such as doorbells, battery chargers, X-ray and violet-ray machines and leaky power lines. His equipment consists of nothing more than a coil or loop antenna that revolves, and a radio-receiving set of a portable, rugged type. With his outfit conveniently installed in an automobile, he can make wide surveys about his neighborhood, seeking the source of the trouble. Once it is located, correction is sought by cooperation between the owner or owners of the disturbing elements and the radio users.



© Harris & Ewing

Seeking Source of Interference, a Radio Detective on the Job with His Equipment

More than 100,000 Already Have Been Tagged with Leg Labels Then Released to Trace Their Travels

By HARLAN H. EDWARDS

MANY interesting and hitherto unknown facts about the life, habits and travels of wild birds are being established by means of bird banding. This work, authorized by federal and state permits, is being carried on throughout the United States and Canada in co-operation with the biological survey.

Birds are captured for banding purposes in various kinds of traps, all of which, however, effect the harmless imprisonment of the bird until it can be removed. It is then examined, and a tiny aluminum band, or bracelet, placed loosely on one leg, after which it is released. Each of these little bands bears a serial number, which is registered in Washington together with a description of the bird. Every time a bird so numbered is retaken, a record is made, thus adding another chapter to its known history. Although this work has gone on for comparatively few years, over 100,000 birds already have been banded and the number is increasing by leaps and bounds.

Places where trapping and banding operations are carried on soon seem to become known to the birds as sanctuaries, so that the population rapidly increases, as compared to the surrounding territory. In this way, time and energy spent in this work by bird lovers are amply repaid. By banding, one can keep almost daily record of many of the birds inhabiting the locality, while during migration, one may discover the day an individual bird comes and the day it moves on.

The birds display no fear of the trap. They often seem to regard it as a special feeding table and some birds form the "trap habit," entering it several times a day. In fact, one station in Georgia reported a brown thrasher as spending most of every day in the trap, while a cardinal became such a nuisance by getting into the trap and keeping other birds away that finally it was found necessary to move it to another location.

Many interesting instances might be given of the actions of the wild birds while being banded. In spring, they often sing their song immediately upon being released. One worker reported a bird as regularly singing while held in his hand. Some birds grasp one's hand with their beak, others with their claws, and some "play possum," but with their eyes open.

This tendency of the birds to remain motionless in the hand, although entirely unrestrained, is of interest. If one releases birds by very gently opening the hand, many of them remain deliberately until they have entirely recovered from their first little scare, before taking wing. Sometimes they stay until the hand grows tired.

There are many things to be learned from the data obtained by banding, the evidence gathered becoming more and

Grosbeak and Myrtle Warbler Family Above; Center, Calaveras Warbler "Playing Possum"; Below, Blackbird at Nest and Golden-Winged Warbler

more valuable as the number of birds banded and recovered increases. It has been proved that certain species of birds return yearly to the same locality for nesting and for the winter seasons. Migrating birds stop at the same feeding places en route year after year. By additional returns, answers to the following questions are expected to be obtained. How long do birds live? Do migrating birds travel each day or linger at places en route where feed is good and the weather suitable? Do they move on ahead of or after storms? How far do birds wander in their daily feeding? If birds do return to the same nesting place year after year, will they use the same nest and have the same mate? After the young birds leave the nest, do they stay in the same locality? Do birds raise a second brood in the same nest or near by? Do young birds return to the same place another season? What are the routes and speed of migration of the various birds?

Definite data bearing on these questions are already being obtained. Each year adds to the number of banded birds which are at large, and also produces multiplying records of birds which have returned to stations at which they were first banded. Reports are being constantly received concerning banded game birds which have been killed at various points, all, when analyzed, of interest.

By ascertaining migration routes, especially of game birds, preserves can be established at various points to afford the birds protection while traveling to and from their nesting grounds in the far north country. That some action must be taken in the near future to prevent extinction of our game birds is becoming more apparent, as can be attested by the increasing scarcity of birds at various hunting grounds. Some birds, once abundant, the passenger pigeon, Eskimo curlew, etc., are already extinct. Others, the prairie chicken, whooping crane, trumpeter swan, and some of the ducks and geese, are so reduced in numbers that their extinction seems imminent.

Among the many interesting migration records already established are those of a number of ducks banded at Browning, Ill., while in migration. From the bands returned, many of the birds traveled as far north as central Manitoba and Saskatchewan, others as far south as the Texas and Louisiana coast, while a few stragglers got as far east as the Atlantic ocean. Among the longest recorded distances traveled was that of a common tern which

Flock of Fulmar Petrel Following a Whaling Vessel for Scraps; by Leg Band Tracers, Much Is Being Learned of Birds More Difficult to Study

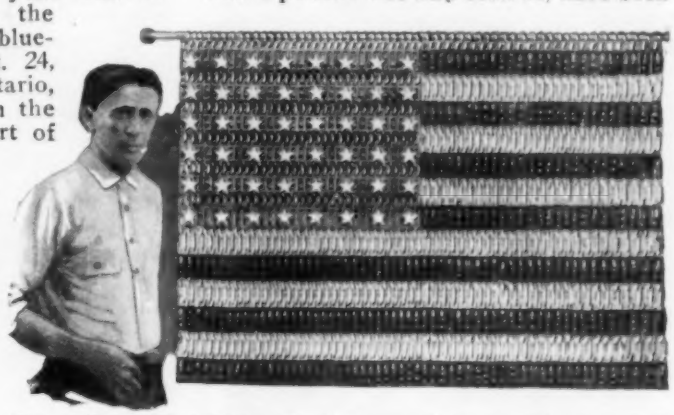
was banded at Eastern Egg Rock, Me., July 8, 1913, and was found in August, 1917, on the Niger river delta, West Africa. Another, banded at Brigantine island, N. J., in 1920, was found two years later in Paria bay, Trinidad, off the coast of Venezuela. A blue-winged teal, banded Sept. 24, 1920, at Lake Scugog, Ontario, was found Dec. 9, 1920, in the Caroni swamp, near Port of Spain, Trinidad. Black-headed gulls, banded at Rossiten in northern Germany, were recovered at the island of Barbados, W. I., and off the coast of Vera Cruz, Mexico. Perhaps the reader may be the one to find a bird bearing a tiny aluminum band on one leg, on which a number is stamped together with the abbreviations "Bi. Surv." and on the back, "Washington, D. C." This bird may have been banded in some far-off place and its recovery forms a valuable link in the chain of evidence being gathered. If such a bird is found or taken either alive or dead, the fact should be reported at once to the United States biological survey, Washington, D. C. If the bird is dead, the band and identifying parts of the bird should also be sent, together with the date and place where found, and the name and address of the person who found it. If the bird is captured unharmed, jot down the band number carefully before releasing it, and send the data with a description of the bird.

FOURTEEN MILLION OWN HOMES IN U. S., SURVEY SHOWS

Although America has been called the most extravagant country in the world, home making is one of its biggest industries, a building association's survey shows. Construction of residences constituted sixty per cent of the year's $6,000,000,000 building program, and it is estimated that 14,000,000 American families are home owners. Approximately $3,000,000,000 a year is spent for automobiles, with almost as much for tobacco.

U. S. FLAG OF WOODEN CHAINS CARVED WITH KNIFE

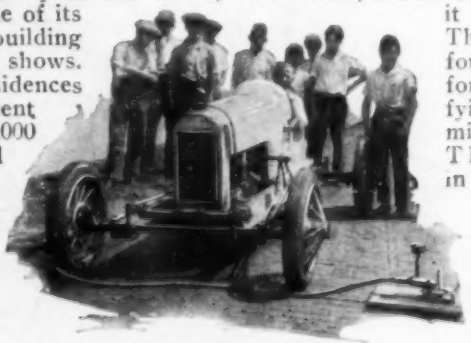
Chains of poplar-wood links, carved with a pocketknife and colored, have been formed into a United States flag by an Indiana craftsman who spent several years' spare time on the task. It is three feet wide and five feet long, and is tinted on both sides so that it is reversible. The chains are supported at the top on a strong metal bar.



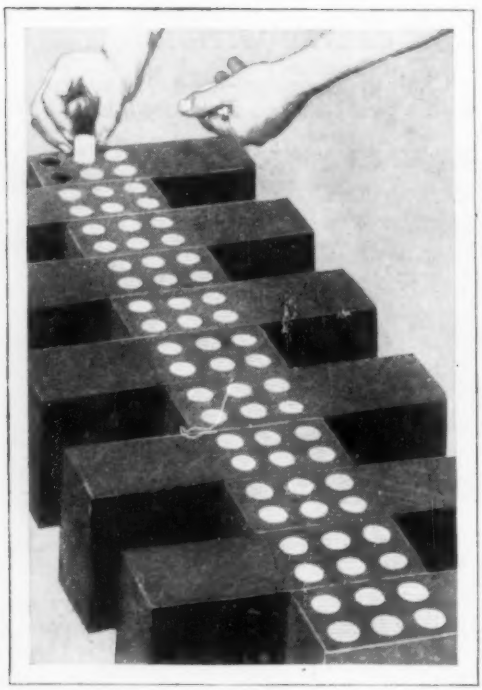
Flag of Poplar-Wood Chains and Its Carver; Links Are Colored on Both Sides and Supported by Rod

RACING AUTOS REGISTER TIME BY RUNNING OVER HOSE

To insure greater accuracy in timing racing automobiles, a western inventor has developed a simple outfit which eliminates the human factor. It consists of a water-filled length of hose laid across the track with a plunger and lever connected to a stop watch at one end. When the car runs over the hose, water forced against the plunger actuates the lever and starts the watch. Returning from a lap around the track, the auto stops the timepiece as it recrosses the hose. The equipment has been found especially useful for timing cars in qualifying rounds to determine positions in a race. The automobile shown in the accompanying illustration is equipped with a special type of supercharger which makes 24,000 revolutions per minute when the motor's speed is 4,000 revolutions per minute.



When Auto Runs over Hose, Plunger Starts or Halts Stop Watch on Stand



White Tile Markers for Traffic Lines and How They Are Inserted in Wooden Blocks

TILE SET IN PAVING BLOCKS TO GUIDE TRAFFIC

Permanent lines for the guidance of traffic are provided by round pieces of white tile set in holes bored in wooden paving blocks. Although they appear as rows of white dots when seen at close range, from a distance they give the effect of a solid line. They do not wear away as does paint, so need little renewal, are easily cleaned and do not readily become dislodged.

DARK-COLORED HOUSE WARMER THAN WHITE

That the interior temperature of a house during the summer months depends to a marked extent upon the color of the outside surface, has been proved by a series of experiments. It was shown that darker colors are as much as ten degrees warmer than lighter ones, and that most unpainted buildings will be warmer in summer than those painted white or a light tint. The tests were made with metal containers and both wood and iron panels, all painted in different colors. They were exposed on the roof of the laboratory on a day when the official air temperature was eighty-two degrees Fahrenheit. Thermometers were inserted in the ends of the specimens and regular readings taken. Wide differences were noted. For instance, the unpainted metal container showed a temperature of 102 degrees, but the black one registered 114. The interior of the white wood panel was only 104 degrees but the thermometer went to 130 in the black one. The white iron panel was twenty degrees cooler than the one without any paint. The tests were held to indicate the importance of planning color schemes for new houses, as a difference of a few degrees often represents the difference between comfort and misery.

PLANE GOES THIRTY-FIVE MILES ON GALLON OF GASOLINE

Weighing only 320 pounds, a small airplane that won the speed and efficiency tests at Mitchell field, flew thirty-five miles on one gallon of gasoline. It is estimated that it could make a trip from Chicago to New York at an expenditure of only about $5 for gasoline and oil. The wing spread is sixteen feet and the length fourteen feet three inches. The plane can attain a speed of eighty-five miles an hour.

One Man Can Lift Tiny Airplane, as It Weighs Only 320 Pounds, But It Can Fly Eighty-Five Miles an Hour

Syncopated Music, with the Variations Introduced by Jazz, Depends for Many Effects on the Wind Instruments

Where Jazz Comes From

Distinctive American Form of Music, an Accidental Discovery by Four Boys, Now Being Adopted into Classical Forms

By EARL CHAPIN MAY

AT a national convention of music industries, a piano manufacturer attacked jazz as "a series of animal howls —a yowling of jungle creatures." About the same time, several thousand lovers of music assembled to hear Eric Delamarter, internationally famous as organist, conductor and composer, interpret his complete jazz symphony with the aid of one of the largest pipe organs in the world and eighty-five members of the Philadelphia Symphony orchestra.

The debate on the question, "Resolved: That jazz is a distinctive American form of true music," waxes more violent with its increasing popularity. The violence of the debate is equaled only by the argument over its origin. As a matter of fact, the question of where jazz originated finds a parallel in that classically moot query, "Which came first, the egg or the hen?" Even the origin of the word "jazz" is in doubt, and few agree on what style or type of music shall be justly called jazz. But several years of study and practical experience lead to the conclusion that jazz is the offspring of syncopation, plus a multitude of non-musical notes and a wealth of effects by the traps and the drums, and other similar instruments that are sounded by beating. Syncopation is the stressing or accenting of the afterbeat in music. It antedates music because the first drum corps in the wilds of Africa went in strong for syncopation. The savage who evolved a drum, by stretching dried skin across the end of a hollow log, made "drum talk" by accenting the afterbeat. The Kaffir coal miners of the Rand rally around their syncopating drum corps to this day. You'll find syncopation among the Peruvian drummers of the Andes, the Siberian drummers with their bone drumsticks, and the Tibetans who drum upon human skulls.

John Sebastian Bach, "father of modern music," was using syncopation in his "Well Tempered Clavichord" and other compositions before 1750. Ludwig Van Beethoven wrote syncopation into the Scherzo movement of his Opus 18, Number 6, before 1800. When our south imported slaves, it also imported syncopation from Africa. When the dives of the old Barbary Coast of San Francisco introduced us to the one-step and fox trot they adopted a syncopation, developed in Buenos Aires, Argentina, which came from the tribal dances of Brazil. But the

Charlie Chaplin, a Southpaw, Leading an Orchestra in One of His Own Compositions

effects by which modern jazz is identified originated in our own southland and its negroes. We first came to recognize them in the negro blues. W. C. Handy, an Alabama negro, put the blues on our musical map. Handy was proprietor and manager of a dance orchestra. One night, more than thirty years ago, he was filling an engagement at the little town of Cleveland, Miss. Three local negroes applied for permission to interpolate a selection. This permission granted, the trio, equipped with mandolin, guitar and bass viol, played, over and over again, a mournful, primitive strain of twelve instead of the orthodox sixteen measures.

There were just three changes of harmony in this unfinished symphony, but it made a hit, partly because the guitar and mandolin players slid their fingers along the frets and produced the effects we now hear in the Hawaiian steel-stringed guitar and ukulele and partly because the bass-viol player "wolfed" his tones. White folks present showered money upon the local negroes.

Handy sat up and took notice. He studied the new type of music, which had a melody something like the negro spirituals, but encouraged encores because it left the impression that there was something more to come. One result of Handy's study was the composition which has won fame as "The Memphis Blues." It was a song without words at first, but it went big. Then Handy wrote some verses for it, referring to a Memphis election campaign. They were not so good. George Norton, a white man, contributed a new set of verses, which became permanently attached to the Handy melody.

© Keystone

A Band of Original Syncopators, the Kaffir Drum Corps Gets Jazzy Results by Accenting the Afterbeat

Chaplin Directing the Phonograph Recording of His Own Compositions, Above, and a Jazz-Band Member with a Few of His Rythmic Reeds

praising the hospitality of Memphis and the skill of Handy's orchestra.

"The Memphis Blues" traveled from coast to coast. There was an outbreak of blues in every musical quarter. The ragtime craze followed. But jazz was still unborn. It remained for four New Orleans white boys to add that word to the world's vocabulary.

Nearly twenty years ago, this quartet of youngsters did the usual kid tricks in the Crescent City. They followed the street bands. They imitated them on mouth organs and "kazoos." Presently, and somewhat blindly, the boy named La-Rocca found himself the leader of the band of four, and also the cornetist. By the same undefined process, the youth named Edwards began to master the seven positions of the slide trombone. Young Shields became "one of those grinning fools who suck a stick," in other words, a clarinetist. And young Scar-

boro became intrigued by the manifold possibilities of the traps and instruments of percussion, so often now referred to as the "battery."

Without an hour of professional instruction and in total ignorance of notes as written, the boys announced themselves as the Dixieland band. The announcement made no immediate sensation in New Orleans. The band's services were not in instant demand. In fact, the four boys knocked at the door of opportunity for months before they finally forced themselves into a job at a local dance. The remuneration was six dollars or one dollar and a half for each budding musician. Other jobs followed. Then fate beckoned them to a popular grill.

The Dixieland band made good because, in their ignorance of written music and innocence of technique, the boys committed many atrocities in the name of the muse. The violinist wolfed his tones, which no good musician should do. The trombonist blatted and sounded many a flat and sharp where accidentals should not have been heard. The cornetist achieved blue notes by blowing on his cornet when the water key was open. The trap drummer indulged in many a raucous noise with the aid of cuckoo calls, horse neighs, nose blows, and other devilish devices. But they made a hit and their fame spread to far-off Chicago. Down from Chicago, in 1914, came a restaurateur named James. James came, heard and was conquered. He offered the four New Orleans boys the princely sum of twenty-five dollars per week a piece and all expenses to play in his Chicago restaurant. The offer was accepted with alacrity. Mr. James was given no time in which to change his mind.

Half scared and half thrilled, the four members of the Dixieland band opened their Chicago engagement in the Boosters' club. They were a riot. Police reserves were called out to keep the mobs of patrons at bay. And then one night, while the boys were catching their several breaths after an unusually enlivening blue number, somebody in the restaurant —it has never been decided just who did it—shouted, "Jazz 'er up, boys."

Now there are thousands of jazz orchestras in this country. Almost every town of 5,000 has one or more. Few vaudeville programs are complete without a jazz number. Many a student in our institutions of higher learning is completing his education by playing

Rehearsing a Jazz Selection and Working Out the Parts for the Other Instruments; the First Jazz Band Never Rehearsed, Because None of the Members Knew or Could Read Music

Courtesy The H. N. White Co.

Huge Group of Musical Testing Bells, with a Range of Three Full Octaves, Used to Test Pitch of New Instruments

jazz engagements during the summer. From a quartet of cornet, clarinet, trombone and drums, the modern jazz orchestra has grown into a mighty force for the perpetuating of the reign of reeds and rhythm. First the piano was added. Then came the moaning, wailing saxophone. Then the oboe arrived, and finally all the wood wind instruments and the wealth of imitations to which the trick trap drummer is so much addicted.

The old simple syncopated melodies, such as Irving Berlin's "Alexander's Ragtime Band," have been succeeded by Vincent Lopez and his jazz version of "The Covered Wagon." Our distinguished pianist and composer, Edward Burlingame, has brought out a "Jazz Study" for two pianos. The brilliant Texan, Harold Morris, has composed his "Second Sonata" in which are incorporated many negro tunes. Powell's "Negro Rhapsody," Whithoner's "Times Square" and Carpenter's "Krazy Kat" are among the current contributions to the literature of American jazz.

So many of our jazz orchestras invaded foreign fields that the French government made a determined, although not wholly effectual, effort to bar them, for they were cutting French musicians out of long-held jobs. But the jazz orchestras, augmented by helicon basses and a terrifying assortment of marimbas, chimes, bells, xylophones and whatnots, are sounding the dominant notes in American music. It is nothing for a boy still in high school to be bitten by the jazz orchestra bug and to invest $400 in various bird calls, animal imitations and instruments of percussion, while the professionals go much farther.

I once spent an evening with Ross Gorman, of the Paul Whiteman organization, inventorying his stock in trade. Ross is primarily a saxophonist. But all jazz artists must specialize in effects. Ross was getting his with equipment valued at $3,540.

One trap drummer of my acquaintance has more than $1,000 invested in his imitations and percussion instruments. But it pays them well. Ross makes about $400 a week although that is small change compared to Vincent Lopez and his weekly income of $5,000.

And there is a bit of a joke on those who raise an outcry at the increase in jazz music and orchestras. Some jazz players may make the sounds of jungle beasts. But the interesting phase of the whole situation is that while most of our popular jazz tunes are transcriptions from some classic melody, many of our modern master musicians, especially those who live and move and have their being in cul-

tured Europe, are accepting these jazz tunes as typically American and are giving them what these master musicians regard as classical transcriptions.

So you see there is something to the parallel questions of where did jazz come from and whether the egg or the hen came first. Probably jazz did come from the jungle by very easy stages. But having come from the jungle via Beethoven, Handy, Berlin, and the boys from New Orleans, it is becoming refined by those who sit in the seats of the musically mighty.

Jazz teaches us to keep time to a tune. It also familiarizes us, in theater, dance hall, cabaret or restaurant, with the melodic themes of Rachmaninoff's "Prelude in C," Dvorak's "New World Symphony," Schubert's "Serenade," Handel's "Messiah," Beethoven's "Moonlight Sonata," the Hungarian rhapsodies of Liszt and even Chopin's "Funeral March" and Mendelssohn's "Spring Song."

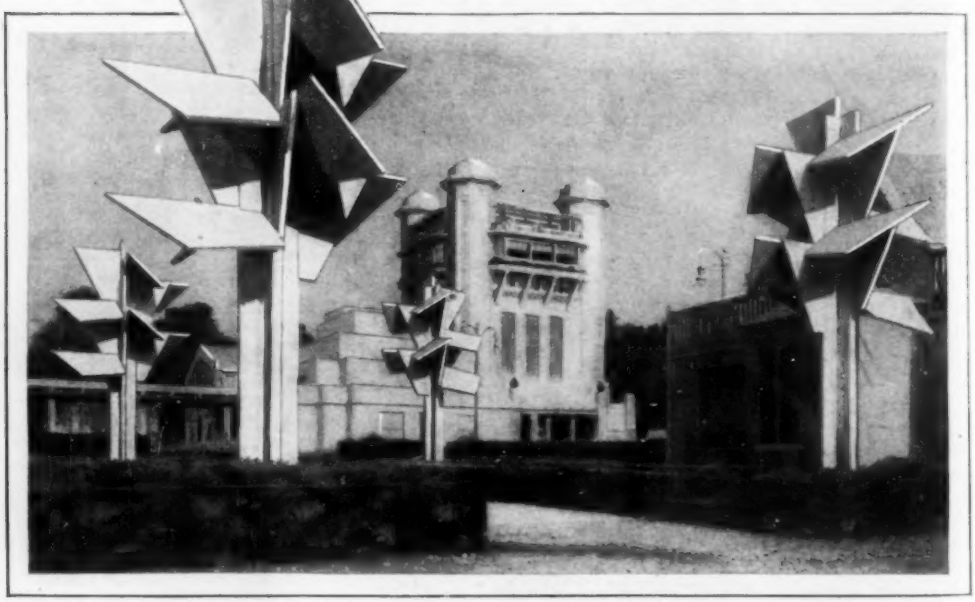
The works of Oscar Strauss have been metamorphosed for the dance hall. Wagner's "Evening Star" from Tannhauser has its jazz version. "Yes, We Have No Bananas" was, note for note, parts of three other pieces, the "Hallelujah" chorus, "I Dreamt That I Dwelt in Marble Halls," to say nothing of that song of our youth, "Aunt Dinah's Quilting Party." Melodious trifles from Nevin, Delibes, Chaminade, Moszkowski, Grieg, Schumann, Puccini and Brahms are revamped into super-syncopated jazz tunes and interpreted for our tapping feet by trombone, saxophone, helicon and drums.

"Home, Sweet Home," "Massa's in the Cold, Cold Ground" and "Carry Me Back to Old Virginny" are jazzed in many a supper show palace. Even Rubinstein's "Melody in F" and the wedding march from "Lohengrin" do duty as fox trots.

But, barring the shock this gives the musically expert, I see no harm in it. Melody is the basis of all true music, and if the jazz orchestras familiarize the great American public with melody, much good must come from it.

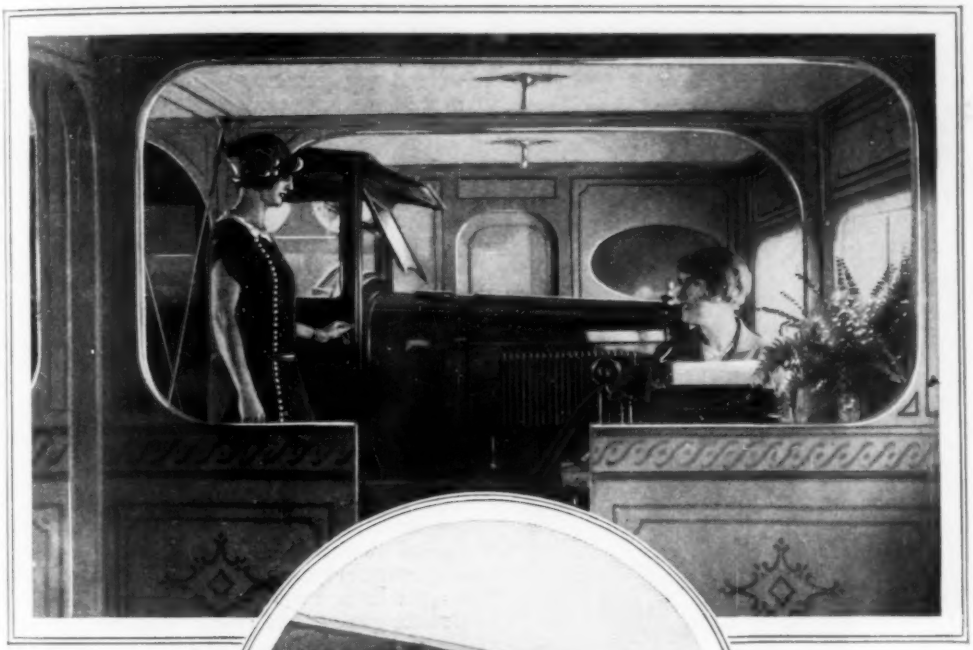
TREES AND LEAVES OF CEMENT FORM GARDEN DECORATIONS

The possibilities of cement in the decorative arts were further illustrated at a London exhibit featured by grotesque replicas of trees molded from the material. The so-called cubist influence was apparent in the designs. The broad, sharp-angled leaves, resembling big shingles, were set at varied positions to give the effect of branches, and the trunks were four-square columns set close together. Advantages of the "property trees' are that they can be placed where natural ones would not grow and that they blend with certain bizarre architecture.



When Cement Workers Turn Artists; Fantastic Trees Shown at London Exhibit to Illustrate the Possibilities of the Material for Garden and Exterior Decoration; Buildings Also Were of Strange Design

SALESROOM IN AIRPLANE HOLDS AUTO AND DESKS



Interior of Salesroom, Housed in Airplane, with Sample Auto and Office Workers, and Exterior of the Ship

Has the day of the "flying office" arrived? A step in that direction has been achieved in a monster airplane with a wing spread of eighty-seven feet. Its fuselage was fitted up as an automobile salesroom, containing a sample car and office equipment, in addition to sufficient accommodations for the necessary personnel.

ORCHIDS FOUND IN FAR NORTH IN STEAM-HEATED VALLEY

Legends of a "tropical valley" in the extreme northern part of British Columbia, where orchids and wild honeysuckles grow in rich profusion near mountains capped with ice, have been verified by official reports from Maj. E. B. Hart, who was commissioned to make a survey of the province. His findings, now on file in the archives at Victoria, not only substantiate the tales of Indians and trappers who described the valley and its 300,000 acres of good land, but explain the apparent mystery of its mild temperature. Hot springs, extending along the course of the rivers Liard and Toad, literally steam-heat the valley so that even in winter, the depth of snow is not over six inches, while less favored areas are blanketed to a depth of three or four feet. In season, upon bottom lands, are found luxuriant pine grasses, pea vine and lupins with an occasional orchid, while scattered growths of poplars attain a diameter of fifteen inches. Maj. Hart attributes the springs to weak spots in the earth's crust.

¶Approximately 21,666 gallons of gasoline are produced in the United States every minute.

ELECTRIC-HEATED HAT BLOCK PREVENTS SCORCHING

Danger of scorching hats when shaping them is practically eliminated in an electrically heated block with a red safety

Electric Hat Block, Showing Control Switch and Safety Light That Signals Too High Temperature

light that flashes when the danger point is reached. The block has a two-heat control switch to maintain an even working temperature, is warmed quickly and is adapted to hats of different sizes.

ONLY TENTH OF AMBER SUPPLY FIT FOR PIPE STEMS

Combing the beaches of the Baltic sea as their ancestors did 3,000 years ago, fishermen every fall search for precious bits of amber washed up by the waves and tangled in the seaweed. The material is petrified rosin from prehistoric forests and about half of the world's annual supply of 250,000 pounds is found here. Although there are many imitations, the demand for real amber is still great, and the introduction of substitutes has not changed the methods of the fishermen. They must brave rough weather, for the bits are washed in most plentifully only when the winds are strong and blow from the direction of the submarine deposits. Weeds likely to contain amber are dragged in with forklike rakes, and pieces that may be dropped to the sea floor, are caught in nets attached to the end of long poles. The workers wear mufflers to protect themselves against the cold, and dash in upon the beach every few moments to warm themselves at fires which the women have built. If the weather is unusually severe, the fishermen link themselves together with rope like Alpine climbers. Catches of twenty to thirty bushels of amber within three or four hours were known in the eighteenth century when the supply was more plentiful. Such a haul was valued at more than $4,000. Like diamond miners, amber fishermen are lured by chance and dream of finding large pieces such as the thirteen and one-half pound lump picked up in 1803 by a stroller along the beach. It is now in a museum in Berlin and is valued at $10,000. Out of every 100 bushels gathered today, only about one is fit for carving into pipe stems and other articles. Some bits imprison rare leaves or insects and these are in great demand among scientists. Associated with legends, and a rival of spices in building up trade routes and spreading civilization, amber was regarded by the ancients as a mysterious substance because of its magnetic properties when rubbed. The Greeks gave it the name "electron."

LONG-HANDLED SOLDER DIPPER PREVENTS BURNS

For soldering or tinning joints overhead or in other difficult positions, a dipper with a swinging cup that always remains upright, prevents dangerous burns that often occur from spilling, and eliminates waste. The solder requires but one heating for fifty to seventy-five joints, it is claimed, as sufficient warmth to keep it liquid is retained in the cup. Longer handles may be substituted for the regular one, if desired, so that a stepladder is unnecessary.

¶As a substitute for glass, a transparent sheeting material now on the market has been adapted to crystals for watches. The disks will not break, are held in place by a patented bevel and can be trimmed to fit with scissors or a file.

The Campus, with Two Main Buildings, of One of the Large Correspondence Schools, Which Has Educated Hundreds of Thousands of Students in Their Spare Hours at Home

By DR. FRANK CRANE

BENJAMIN FRANKLIN said, "Investment in knowledge always pays the best interest."

A comparatively rich man once said, "The way to have money is to spend less time skimping pennies on small salaries and more time on preparing yourself for high-salaried positions. If you make yourself worth enough, more money will come."

Good health and a trained mind are the two legs that raise a man above the crowd. He should form sane habits of living for the sake of his health and then devote himself to improving his mind.

Inventive genius is one of the things that is no respecter of persons. The poor man who cannot afford a university training may possess it. He needs the tools of knowledge to liberate it. The easier access to advanced learning through home-study courses has placed these tools within the grasp of all.

It is interesting to note that few of the men who have given us our great revolutionary inventions have been men of favored circumstances.

Instructors' Room in a Correspondence School, Where the Lesson Papers of the Students Come for Correction; Faculties in These Colleges Are Often Larger Than in Many Universities

Part of the Mailing Department in a Correspondence School, Where Lessons and the Corrected Papers Are Distributed into Regional Sacks to Speed Up Post Office Delivery

The little hunchback immigrant, Steinmetz, arrived in the steerage in the late eighties. He was penniless and his first job paid less than that offered a ditch digger.

Henry Ford, when a mechanic in Detroit, built his own modest little house at night after work, while his wife held a lantern.

The man who gave us the telephone was in dire poverty even after a company had been formed to advance its use. It is said that on the early books of the treasurer of the company can be seen such items as "Lent Alex. Bell fifty cents."

In 1869, when Edison came to New York, he did not have a cent. He had left his books in Boston as part payment of his debts. It is said that his first meal in New York consisted of tea which he begged from a professional tea taster whom he saw at work.

Real genius lies oftentimes in those who cannot afford attendance at an institution

A Corner of the Reference Library of One Big Mail School, Where Complete Collections of Books on All the Subjects Taught Are Available for the Use of the Instructors

of higher learning. Home study opens the door for those who are willing to apply themselves.

No such course will do it all. The result depends ultimately upon the man. But it will help him direct his energies.

Like prohibition, evolution and the Ford automobile, correspondence schools have been made the butt of countless jokes.

The result is that some people lose sight of the significance of the work they are doing.

About twenty-five years ago, they began to assume prominence. During the years since, they have been one of the big influences in the tremendous and beneficial attempts to "popularize" knowledge. They have helped take the mystery out of technical subjects. They have sought to bring knowledge within the grasp of the common man.

Real progress comes when the mass of the people are being educated instead of a few. In the thirteenth century the Renaissance gave the world a handful of superscholars, but left the masses in poverty and ignorance.

The past quarter of a century has been one of putting spearmint in the intellectual chewing gum. The result is that the average amount of education is being raised.

Coincident with this rapid expansion of popularized education, there has been a period of unparalleled fruitfulness in mechanical inventions. The almost unbelievable progress along the lines of aviation and radio are examples.

There can be little doubt that this increased activity is largely due to the wider spread of scientific knowledge to the common man.

It is when a man stops studying that he ceases to grow.

Everyone should go to college if possible. However, for many reasons, a college education is impossible to many.

Thwarted in his ambition for a college education, a young man can do one of two

A Section of the Students' Service Department in One School, Where Records of the Lessons Mailed and Received, with All Other Work Done by Each Pupil, Are Kept on File

things. He can give up or he can study at home. If one has the will power to study at home, the struggle in itself is a developer of character.

To take yourself by the scruff of the neck and make yourself get down to work after dinner in the evening instead of listening to the latest jazz music over the radio, means that you are gaining self-control, which is one of the ends of all education.

"The science of education," Charles P. Steinmetz, the electrical genius, once said, "is the science of helping people find out what they want to know."

Too often the fight for success is likened to a football game or a prize fight, where you smash your way through the opposition of others.

In truth it is oftener like traveling a lonely road.

In the "Americanization of Edward Bok," the former editor tells of his surprise at this discovery. He says:

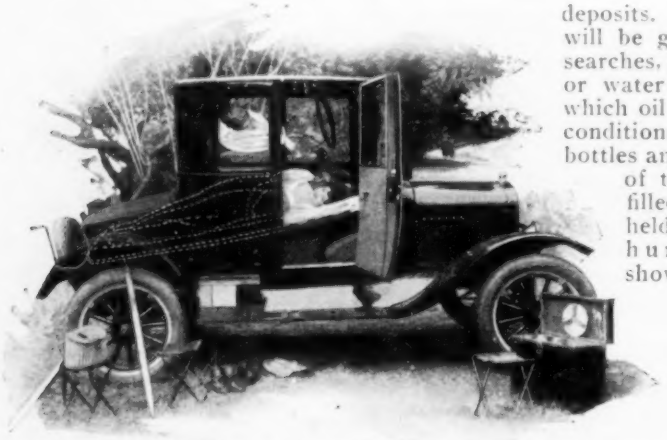
"The path to success is wide open. The competition is negligible. There is no jostling. In fact, to travel in it is lonely."

This is what the man who studies at home must remember.

There are few sudden spectacular conflicts to wrestle with. There is only the steady grind of making yourself fit for bigger things. There is the constant internal struggle resisting the desire for a "good time" when there is work to do. There is the strain of keeping to the lonely path of self-control and hewing to the line of a determination.

This is the road to achievement and it is the biggest test of a man's real worth.

The big problem is to get ahead within yourself and not to get ahead of someone outside of yourself. That will take care of itself.



Dotted Lines Indicate How the Double Bed Extends to Rear of the Coupe; Bed for Child Above

FOLDING BEDS IN AUTO COUPE HOLD THREE PERSONS

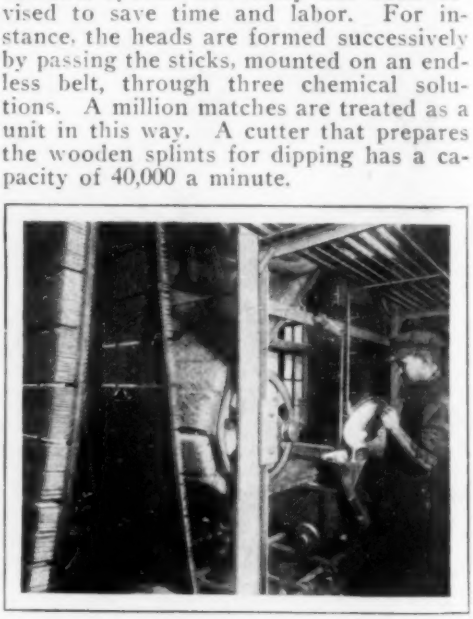
Occupying but little space when folded up, a bed big enough for two persons fits inside the auto coupe which needs little remodeling for the installation. In addition, sleeping space is provided for a child across the seat back. The springs of the larger bed are suspended only at the ends, increasing comfort and the mattress is an inch longer than the standard size. It extends the full width of the coupe and back into the rear part of the body. When not in use, the beds are concealed and can be put down or made up in less than two minutes, the manufacturers assert.

SAND GRAINS ROLL MANY MILES BEFORE BECOMING POLISHED

For most sand grains, a journey equivalent to two trips from the center of the continent to the ocean is necessary before they acquire a round, smooth shape. They wear away much more quickly when carried by water than when borne in the air. These are among the results of a western professor's three years' study of sand to discover the origin of oil-bearing deposits. Prospectors, he believes, will be greatly aided in further searches, if they know whether wind or water laid down the strata in which oil is found. To study actual conditions, grains were placed in bottles and rotated on drums. Some of the containers were partly filled with water and others held only the sand. In a few hundred hours, the sand showed practically the same effects that result from hundreds of years of natural weathering.

MILLION MATCHES MADE AS ONE

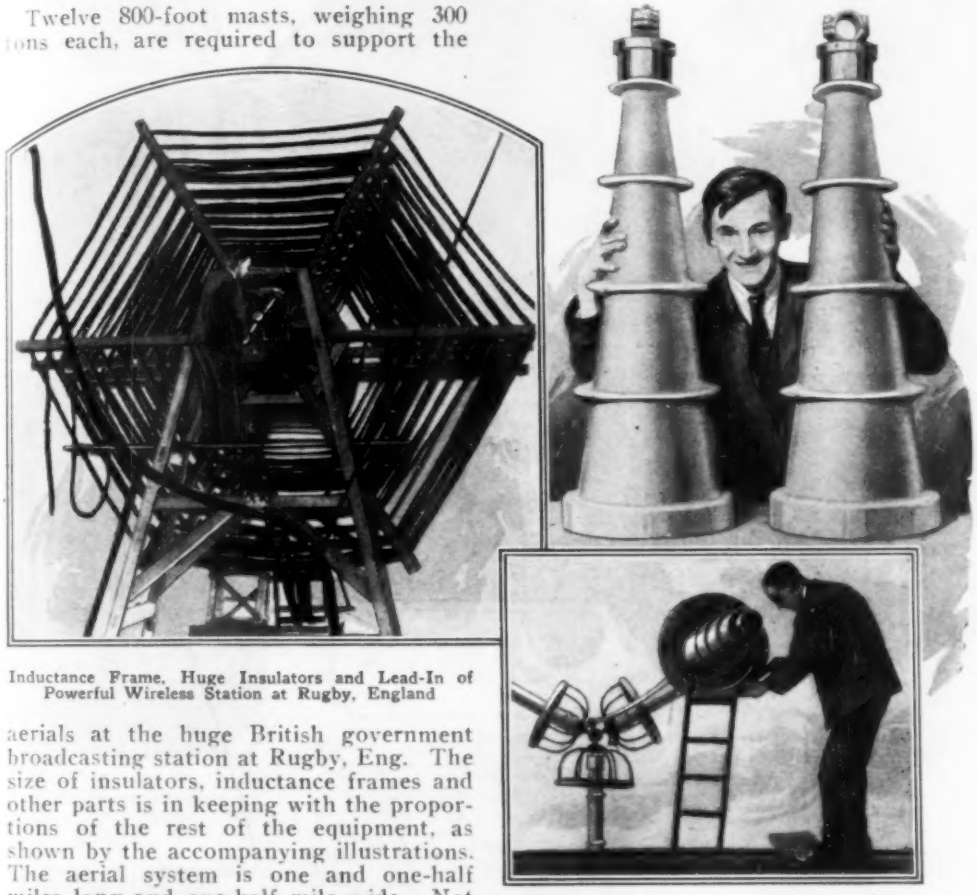
Quantity production is imperative in match manufacturing, and to meet the enormous demand, special machinery has been devised to save time and labor. For instance, the heads are formed successively by passing the sticks, mounted on an endless belt, through three chemical solutions. A million matches are treated as a unit in this way. A cutter that prepares the wooden splints for dipping has a capacity of 40,000 a minute.



As Matches Attached to Endless Belt Pass through Chemical Baths, the Heads Are Formed

MASTS AT HUGE RADIO STATION EIGHT HUNDRED FEET HIGH

Twelve 800-foot masts, weighing 300 tons each, are required to support the



Inductance Frame, Huge Insulators and Lead-In of Powerful Wireless Station at Rugby, England

aerials at the huge British government broadcasting station at Rugby, Eng. The size of insulators, inductance frames and other parts is in keeping with the proportions of the rest of the equipment, as shown by the accompanying illustrations. The aerial system is one and one-half miles long and one-half mile wide. Not far away, at Daventry, is another large station with two 500-foot towers placed 800 feet apart. They are anchored on top of a hill 600 feet above sea level, so, from the standpoint of altitude, are the highest in England. Both are expected to be important units in the British empire scheme of international communication by radio.

WINGLESS PLANES PREDICTED AS RESULT OF ARMY TESTS

Motors that can propel airplanes without the lifting power of the wing surfaces have been developed, army tests disclose. Using a Curtiss D-12 racer, Lieut. Russel Maughan flew edgewise, maintaining a straight course at 225 miles an hour, the body alone being sufficient to support the weight. Pursuit airplanes of the future, army officials predict, will be literally "winged projectiles," mostly engine and propeller, and with wings of the minimum length and surface required for taking off, steering and banking.

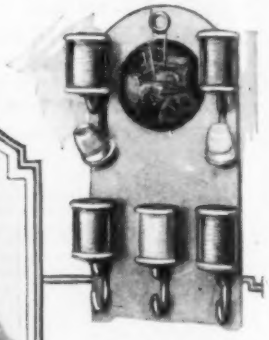
COPPER TAKEN FROM WATER WITH AID OF TIN CANS

Nearly 100,000 pounds of copper are salvaged annually from the water of a mine by running the liquid through heaps of old tin cans and scrap iron. The process first produces iron sulphate, due to the action of the water in eating away the iron. From this, a sludge is formed which, when dried, assays fifty per cent pure copper. Each 1,000 gallons of water yields five and one-half pounds of metal. The mine flow is pumped through steel pipes lined with wood into long troughs, where most of the copper is deposited. In six months, 155 tons of tin cans and forty-seven tons of scrap iron were consumed by the process.

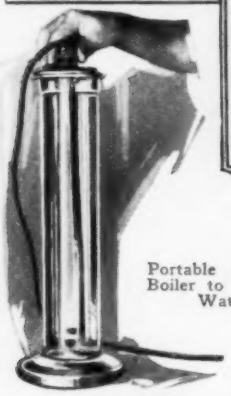
Time and Money-Saving Tools

Faucets Can Be Mended without Tools by Using This Split-Pin Washer That Is Pushed in Place

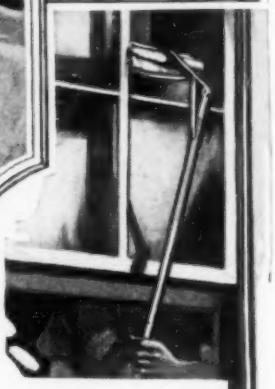
With Baby Safely Seated, Mother Can Drive Car in Comfort



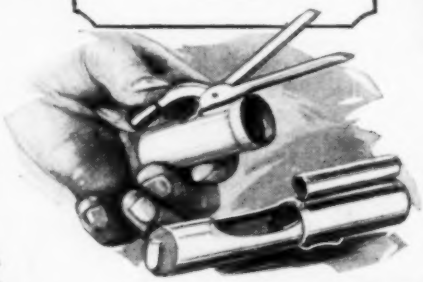
Holder for Sewing Articles Fits against Wall



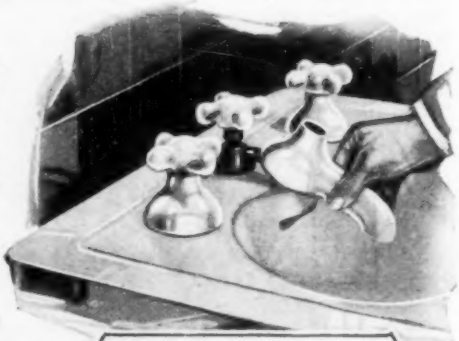
Portable Electric Boiler to Sterilize Water



Cleaning Windows' Outer Surface from Inside in Safety



Fitting into a Case Less Than Four and One-Half Inches Long, a Pocket Curler Is Always Ready; at Left Is a French Floor-Waxer Intended to Give Even Pressure on Every Spot



Removable Porcelain Covers for Bathroom Fixtures Improve Appearance

Anyone wishing further information on devices described in the editorial pages can

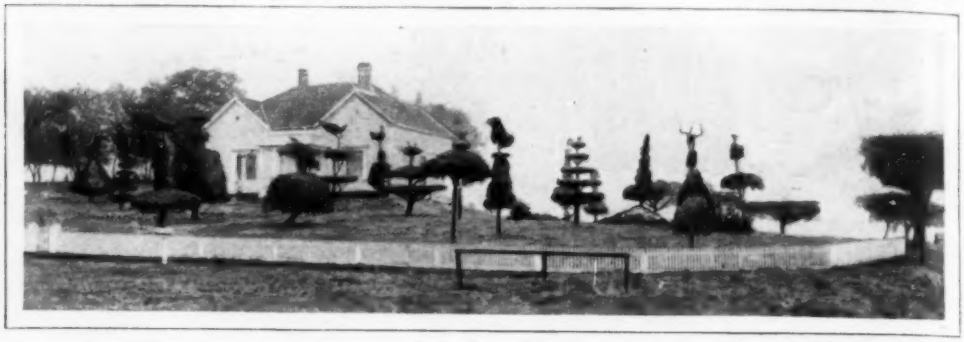
for Woman's Workshop in Home

"Gear-Shift" Meat Grinder Changes from Coarse to Fine Knife by Pressing Lever
Metal Shields to Keep Dust Out of Corners Are Easily Installed and Save Work
Electric Water Heater and Radiator in Wall Add Luxury to Bathroom
Pail for Many Uses Fits inside White-Enamel Swing-Top Holder
Sealing Tape to Keep Juice in Pies
Lighter Pastry Dough and Quicker Work Are Possible with Double Rolling Pin
Patching Compound for Use Instead of Sewing and Darning Withstands Laundering Processes
ICE CRUSHING BAG
Heavy Canvas Bag Will Not Tear When Crushing Ice
Mop Wringer That Does Not Splash and Saves Stooping

obtain it by addressing Bureau of Information, Popular Mechanics Magazine, Chicago.

TREES OF FANTASTIC SHAPES REVEAL TRIMMER'S ART

Years of labor and patient care are represented in the trees of an Iowa farmer's front yard. They have been trained and trimmed into fantastic shapes like weathervanes, spirals, animals and other forms, and in spite of repeated cuttings, have flourished. They are set far enough apart to permit a clear view of each from the road.



Copyright, Henry Miller News Service

Iowa Farmer's Yard of Oddly Trimmed Trees; All Are Thriving in Spite of Repeated Cuttings, and Some of the Designs Are Being Changed by Gradual Pruning

EXPLOSIVE POWER FROM DUST TO RUN AUTOMOBILES

An attempt to convert waste dust, now a serious potential fire hazard and a menace to health in manufacturing plants, into a cheap fuel for producing power is being made by the bureau of chemistry. It would replace coal, gasoline and oil, saving the country millions of dollars annually, scientists predict. According to Dr. C. A. Brown, chief of the bureau, there are many products from which inflammable dust, suitable for fuel purposes, could be derived. These include various kinds of chemicals, metals, wood, leather, cork, grain, rubber, sugar, cocoa and cinnamon. Carbon in these substances combines with oxygen, producing the combustion.

The hazard of grain dust in elevators is well known, and to prevent accidents and explosions, elaborate precautions in the form of construction and in methods of handling the grain are taken. At a recent exhibit in New York, chemists from the bureau made use of this elevator problem to demonstrate the principles of dust explosions and show how they may be able to harness the power to run machinery. Into the miniature shaft of a model elevator, was poured a teaspoonful of corn starch or sugar. A piece of paper was clamped over the top of the shaft. Then air was pumped into the small passage, stirring up the powdered substance which had been carefully dried and finely pulverized for the demonstration. By means of an

Illustrating the Explosive Power of Sugar; Model Elevator Photographed the Instant an Electric Spark Ignited Dust

electric spark, the combination of dust and air was ignited, the carbon in the floating particles uniting with the oxygen in the air and producing a miniature explosion of such force that the paper and its hoop were blown to the ceiling. The test not only showed the unharnessed power lying in inflammable dust, but demonstrated what occurs when a real elevator "explodes," frequently with loss of life and heavy damage.

The most powerful of all fuel dusts is said to be that of aluminum.

METAL PLATING PRESERVES FLOWERS

A process of plating flowers and foliage with metal to preserve their original appearance is being used by an associate of the late Dr. Charles P. Steinmetz. He predicts that roses he has treated with silver in this way, will be found in a perfect state of preservation when the plating is removed ten years hence. Besides the roses, he has prepared golden-maple leaves and copperized bunches of ivy. The method involves an electro-chemical treatment and the scientist asserts that it can be adapted to furs. By a special heating process, he expects to deposit metal on the hairs without destroying their softness. Silver-fox fur, for instance, could be imitated in cheaper varieties, by this coating, it is claimed.

Coating Cut Flowers and Leaves with Metal

TOKYO HIRES SANDWICH MEN TO ANNOUNCE CENSUS

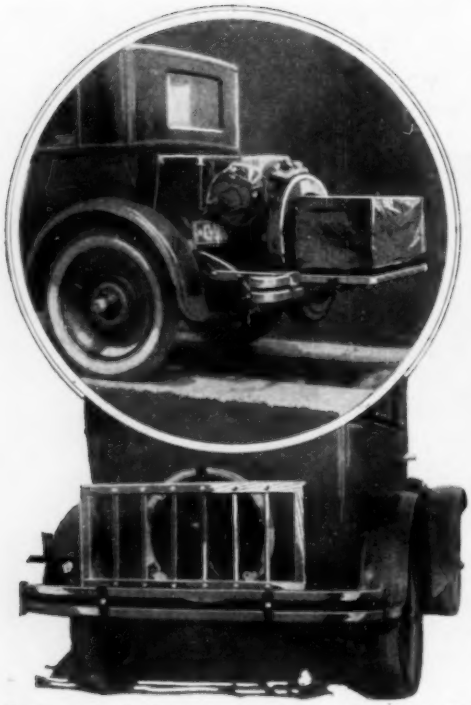
When the census is to be taken in Tokyo, squads of sandwich men, bearing placards announcing the event, are sent into various districts of the city to prepare the population for the arrival of the statistic clerks. This form of advertising, it has been found, reaches more persons than printed notices in the papers.

Tokyo Sandwich Men with Their Signs Announcing a Census Taking, Ready for Trip through City

NUMBER OF FARMS DECREASES FIFTEEN THOUSAND YEARLY

In the past five years, the number of farms in the United States has decreased 75,735, or more than 15,000 yearly, according to the department of commerce. The total is placed at 6,372,608. The decline was not general, some sections reporting increases, as in Texas where a gain of 30,387 farms was shown over the 1920 figures. The greatest decrease was found in Georgia where the total dropped from 310,732 in 1920 to 249,098 in 1925. Illinois had 225,645 farms last year, a decline of 11,536 as compared to 1920, while Wisconsin reported an increase of 3,838 over the previous census.

¶Names and addresses of manufacturers of articles described in this magazine will be supplied by our Bureau of Information.



Luggage Carrier Extended and Folded over Spare-Tire Rim as Extra Bumper

FOLDING AUTO LUGGAGE RACK SERVES AS EXTRA BUMPER

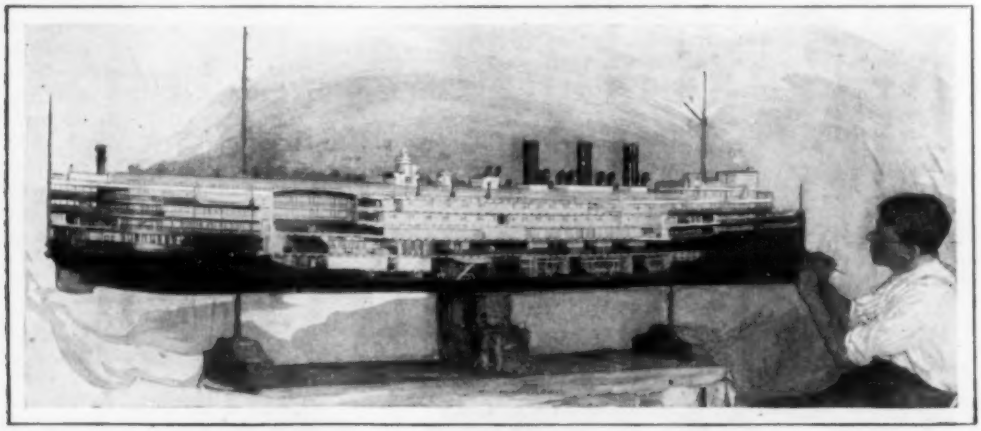
Extending beyond the spare tire to afford extra space, an auto luggage carrier of heavy nickeled steel, may be folded up when not in use, and in that position serves as an auxiliary bumper. It is high enough to protect the back of the car and the extra tire and, fitting flat when drawn up, does not interfere with cars behind.

MECHANICAL EYELIDS' WINK SOLVES MYSTERIES

Perfection in England of a portable binocular stroboscope, or mechanical eyelids, as compact and easily carried as a pair of field glasses, has made it possible for the eye to see things which heretofore it has been too slow to catch. The stroboscope is a device in which a shutter can be opened and closed at any desired rate, so that moving or vibrating objects seen through it can be made to appear as though they were standing still. If the human eye could wink fast enough it could look at a revolving flywheel, and by winking in tune with the movement of the spokes, see them as clearly as though the wheel were stopped. The new portable stroboscope is expected to prove of value in the study of vibration in machinery, since it will allow direct observation of the smallest movement, without setting up complicated apparatus in order to enlarge the vibratory effect so that it will be made visible to the naked eye.

MINIATURE SHIP IS COMPLETE IN EVERY DETAIL

Details of the S. S. "Greater Detroit" are faithfully reproduced, even to carpets, interior decorations and furnishings, in a model of wood and metal completed at a cost of $10,000. Seven men worked on it at intervals for eight months. The replica is built on a scale of three-sixteenths of an inch to the foot. It is so arranged that it can be laid open in order that interiors of the state rooms and holds, and the working parts, even to the smallest details, may readily be inspected.



Putting Finishing Touches on Elaborate $10,000 Model of Lake Steamer "Greater Detroit"; It Permits Inspection of Engine and State Rooms and Is Copied after Original, Even to Carpeting

Fortunes from Tree Stumps

EXTRACTING a fortune from the dead stumps of long-gone pine trees in the millions of acres of cut-over land in the southern states has been made possible by the inventive genius of two men who have developed a process for recovering turpentine and rosin and put it into practice in two southern states.

Using the waste material which the loggers left behind, and which has prevented farmers from taking up the former forest land, they not only are able to recover two valuable chemical products, for which there is a wide market, but prepare the ground itself for agriculture.

Dynamite and modern industrial chemistry have made both things possible.

Less than a century ago, the southern states boasted the world's greatest supply of turpentine and rosin, both used chiefly then for shipbuilding. North Carolina alone was able at one time to produce nearly enough of the pine products to glut the entire world's market. Her forests were so rich that every North Carolinian was said to have his heels covered with pine tar every time he took a walk, a saying from which the residents of the state are still called "tar heels." Today North Carolina produces but a fraction of one per cent of the available supply.

The English settlers had begun tapping the trees in the time of Sir Walter Raleigh to get "naval stores," the old name which still clings to turpentine, rosin and pine tar, though the ships of the world no longer use any appreciable amount of either. Turpentine and rosin gathering are carried on much the same as maple-sugar collecting, except that the trees may be tapped throughout most of the year. From V-shaped slashes the gum exudes and oozes into collecting pans, and then is sent to the distillery to be mixed with water and distilled. The lighter turpentine passes off into storage vats and the gummy rosin is left behind.

The turpentine business remained good until the need for southern-pine lumber became keenly felt after the forests of the Great Lakes region gave out. In recent years, a large part of the south has been stripped of marketable pine timber, and the turpentine industry suffered as a result.

It remained for Homer T. Yaryan, a Toledo scientist, who had invented a process of continuous evaporation for chemical plants, to conceive of recovering the turpentine and rosin left in the stumps, dead limbs and fallen trees left behind by the lumberjacks. He decided the valuable material could be salvaged from the wood by shredding the stumps and then cooking them in live steam. In co-operation with Joseph E. Lockwood he developed the process.

Success was made possible because the turpentine gums are driven to the heart of the stump or log as the outer portion decays. Protected by the rosin, the heart will remain sound for untold years.

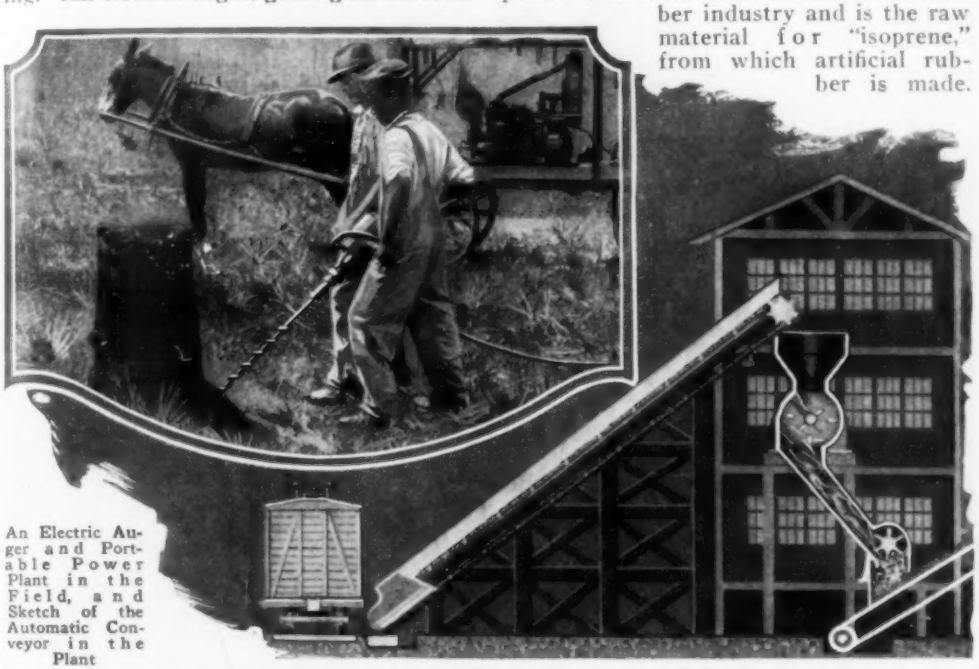
Yaryan and Lockwood built their first plant in Mississippi, and it proved such

Rosin Storage Yards at Savannah, Ga., Above, Where the Recovered Material from Old Stumps Is Gathered for Shipment to Market by Sea

Placing a Stick of Dynamite under an Old Stump to Lift It Out of the Ground; Each Stump Is Blown with a Separate Fuse

a success that a larger and improved outfit was established in Georgia. Their survey indicates there are at least 15,000,000 acres of cut-over land on which to draw for material.

The old stumps are removed by blasting. An electric auger, getting its current from a gasoline-driven generator, mounted on a horse-drawn truck, bores the holes in the stumps. A stick of dynamite is slipped in, a fuse attached and lighted, and the stump and a large section of its roots sprayed over the landscape. The debris is gathered together, loaded on railroad cars and transported to the distillery, where an automatic conveyor lifts it to the hoppers of huge lumber-mill "hogs," massive grinders designed to reduce lumber refuse to the size of matchsticks.



An Electric Auger and Portable Power Plant in the Field, and Sketch of the Automatic Conveyor in the Plant

The shredded material is then placed in air-tight cooking vats and subjected to high-temperature steam, which cooks out the gum and prepares it for eventual separation into turpentine and rosin.

Despite the virtual disappearance of the old-time wooden sailing ships, whose hulls and cordage required vast amounts of naval stores, the market for the recovered product is better than ever, thanks to modern industrial chemistry. Nothing has been found to take the place of turpentine in many essential industries. It is used for thinning paints and varnishes, and has a place in medicine and in making prepared drugs. It goes into shoe polish, as well as floor and furniture polishes, in which it acts as a solvent for the waxes. Patent leather could not be made without it, nor could synthetic camphor. It is used as a solvent in the rubber industry and is the raw material for "isoprene," from which artificial rubber is made. It prevents colors "bleeding" when calico and print goods are stamped and goes into fireworks, wood stains, printing inks, crayons and many other articles.

Rosin, the other product recovered from the waste of the stumps, is a vital element in making laundry soaps and soap powders, sealing wax, axle grease, paint driers, ceramic enamels, cheap linoleum and oilcloth, medicinal plasters, ointments, foundry cores, sticky flypaper, shrapnel-shell filling and in scores of widely varying manufacturing processes.

Besides the two chief ingredients of stumps, the distilling process also yields quantities of pine oil, which is used in the concentration of low-grade gold ore by the flotation process, and in disinfectants and other articles.

Although still young, and operating in only two localities, the pine-stump recovery industry this year used more than 2,000,000 pounds of dynamite to remove the stumps from the ground. The age of the stump is no detriment, since the older and more rotten the exterior, which is discarded, the richer the heart will be.

No stumps cut less than ten years ago are used. By concentrating on the rich heart-wood from a portion of each stump, the same amount of gum is recovered as if the entire stump had been distilled when new, and yet only a fraction of the original amount of wood

Fine Chips of Pine after Passing through the Shredder, Above, and a Close-Up of a Dynamite Blast Showing a Stump Being Removed from a Field of Second-Growth Pine Timber

must be shredded and cooked. How many million gallons of turpentine and pounds of rosin can be extracted from all the cut-over pine forests of the south has never been estimated, but the forestry department of the state of Louisiana estimates that the stumps in that state alone would yield 340,000,000 gallons of turpentine, in addition to a vast amount of rosin.

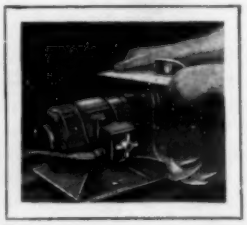
The 23,000 square miles of stump land available in the south is equal to the combined area of New Hampshire, Vermont and Connecticut.

YEARS TO RIPEN CHEESE

Various experiments have been tried and adopted in the manufacture of almost 200 different kinds of cheese, but to gain the delicate flavor of the best Italian grades, no less than four years must be allowed for seasoning. There is nothing in the milk or in the preparation of these varieties that gives them their peculiar flavor and mellowness, it is said. These qualities are dependent wholly on the method in which the cheese is cured and seasoned. As in the maturing of French wines, the cheeses bear data, giving the whole "pedigree" from start to finish, and the exact location of each cheese in the storage vaults is charted on a map kept constantly under lock and key.

ELECTRIC SHEET-METAL CUTTER RUNS FROM LIGHT SOCKET

Weighing only thirty-eight pounds, an electric sheet-metal cutter is said to leave no burr on the material and, when adjusted so that the work can be rested on a bench, may be operated by only one man. On sixteen-gauge steel, it has a speed of fifteen feet per minute, and curves or irregular shapes are cut as easily as straight lines, the manufacturers assert. The action is secured through an eccentric on which the motor-driven cutter is fastened. The knives are removable for sharpening.

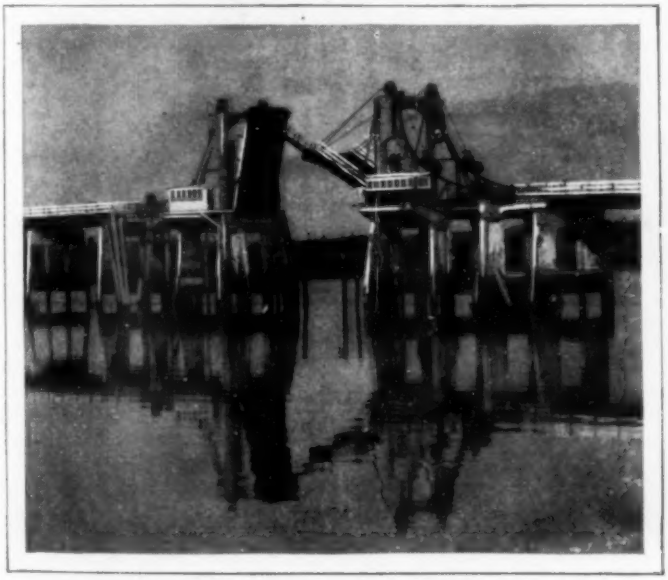


LUSTER OF "DIZZY" DIAMONDS RESTORED WITH SAWDUST

Like human beings, diamonds get "dizzy" and lose their brightness, an English gem expert declares. He restores their luster by rubbing them well with Cologne water and then throwing them into fine hardwood sawdust while still damp. They are whirled in a rubber-lined mechanical shaker until dry and their natural brilliance is practically restored. Plain gold ornaments, such as brooches, fob chains and trinkets which have become shop-soiled, also appear new after passing through the process and then being rubbed with chamois leather.

"ISLANDS" IN ONE-WAY BRIDGE GIVE ROOM FOR PASSING

To save money in the building of a 1,578-foot bridge across the Wairoa river, on the North Island, New Zealand, the structure was erected with only a twelve-foot roadway, sufficient for one-way traffic. Two wider spaces, with eighteen-foot roadways and each 120 feet long, were provided a third of the way from each end, to take care of passing vehicles. Foot passengers were provided with eight bays into which they can detour at the approach of vehicles. As the river is navigable, it was necessary to provide a bascule draw in the channel, with twelve-horsepower engines to operate each leaf.



At the Center of the Bridge Are the Lifts, the Detours Are a Third of the Way from Each End

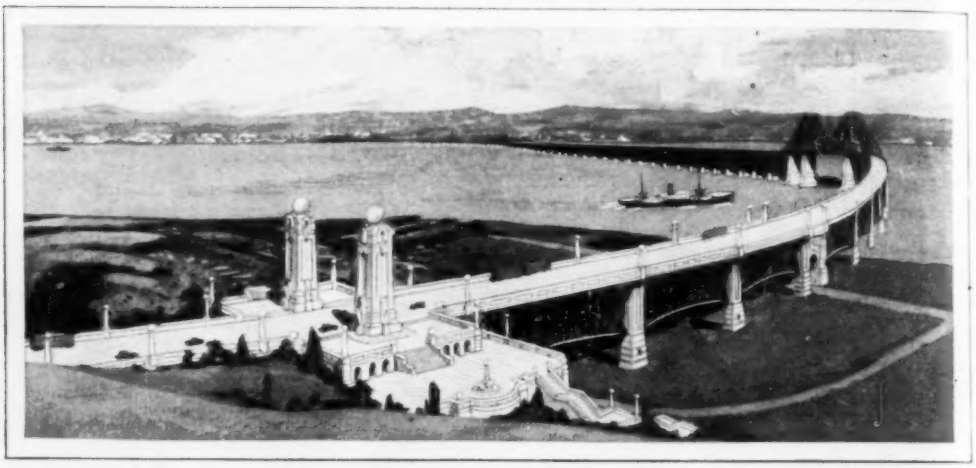
Figured Copper-Screen Radio Antenna That Rolls Up

ANTENNA LIKE ROLLER SHADE SERVES AS PICTURE OR MAP

Wound on a roller like a window shade, a radio antenna consisting of a thin sheet of copper foil between two layers of special insulating material, may be decorated with a picture or a map. The lead-in is attached to a terminal at one end of the top roller. The antenna is quickly arranged for service, occupies but little space when stored away and eliminates conspicuous wires.

¶A dog hotel which boasts 120 "guests" is being operated by a California land-development company. The residents of the two-story hotel are required, however, to furnish their own food. The dogs were imported to run down and kill jackrabbits, which are then cooked and served them for food.

SAN FRANCISCO BRIDGE TO COST SIXTY-FIVE MILLION



Architect's Drawing of Bridge to Connect San Francisco and Oakland; Spans on Each Side Will Permit Passage of Ships and Ornate Columns Will Mark Approaches

Plans for a bridge, costing $65,000,000, to connect San Francisco with Oakland have been submitted. Besides traffic space for automobiles and pedestrians, the structure will provide room for street-car tracks, and spans near each end of the long viaduct will be constructed to permit the passage of ships. Artistic approaches with stairways and ornamental columns are included in the architect's drawings.

DUMMY IN ARTIST'S STUDIO SERVES AS MODEL

Saving the expense of hiring a person to pose, a flexible dummy an artist uses can be arranged in lifelike positions. Head and features have been accurately molded and figure can be costumed as desired. It also serves as a support to steady a live model, when used, in various poses.

Harrison Fisher Adjusting Dummy Model He Uses in Studio to Aid in Portrait Painting

GOLD FOIL, CLEAR AS GLASS, TO IMPROVE RADIO

Gold and nickel foil, but a fraction of the thickness of the thinnest leaf made by hammering, has been produced by a German scientist. The layers are said to be as translucent as glass. Photographs, taken through a covering of the foil over the camera lens, could hardly be distinguished from those made in the usual way. It is expected that the filaments will be especially valuable in studying various phases of radioactivity and forms of energy due to the radiation of gaseous matter. Though but a millionth part of a centimeter in thickness, the centimeter being about three-eighths of an inch, a few of the strips together carried sufficient electric current to light several electric bulbs, and the films could be swung rapidly back and forth without tearing. Practical adaptation of the discovery is expected to improve radio telephones, phonographs, and other appliances that require delicate membranes or conducting surfaces, by bettering tone quality and increasing the range of the instruments. The process was discovered by chance while the scientists was investigating chemical rays. It is being kept secret, but is based upon a kind of galvanic precipitation of the various metals.

Getting Ready for Winter DX

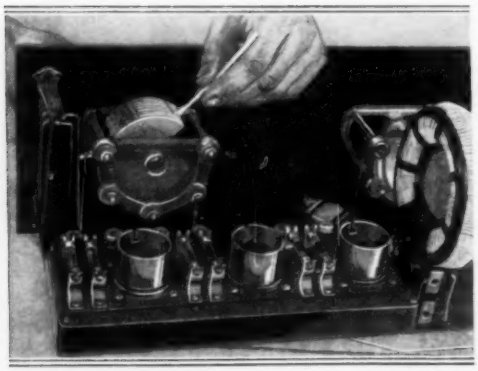
By JOHN R. SMYTHE

WINTERTIME brings the distant stations closer, and the cold clear evenings bring back old friends that have been buried under the summer static, if—and it is a big IF—the set is in proper condition for the best reception. Inspecting the radio set is just as important as automobile inspection. It is sometimes put off until increasingly poor results make it absolutely necessary. Good results depend on first-class equipment kept in working order, and a little attention to these details pays in increased range, better volume, and longer service from the instrument.

Since the set was last overhauled, the vacuum tubes have been burning some 500 or 600 hours. The batteries, especially the B-batteries, have been delivering current over a long period and are most likely run down; noises in the set that probably have been attributed to static are coming from these old batteries, and loss of volume usually can be traced to the same source. If this is the case, put in new batteries so as to enjoy the maximum results.

Remove the tubes, marking each one so that it can be replaced in the same socket, then lift the instrument from the cabinet and place it on a convenient table. The first things to examine are the joints, soldered and otherwise, as these are a common source of trouble unless the work has been done very carefully. Many times, too much flux has been used and this has run in behind the terminal, forming a high-resistance path, or if the wrong kind of flux has been used, corrosion takes place. Remove the terminal nut and clean with a cloth moistened with alcohol and placed over the end of a screwdriver. Replace the nut and tighten firmly. The terminals on the coils, transformers and tube sockets should all be gone over in this manner. Turn the set over and examine the connections; see that each connecting wire is tightly soldered, and that no wire has been bent so as to touch another; each loose joint here should be carefully soldered. Broken joints can be accurately located by operating the set temporarily. Connect the batteries and place the tubes in the sockets; the broken connections

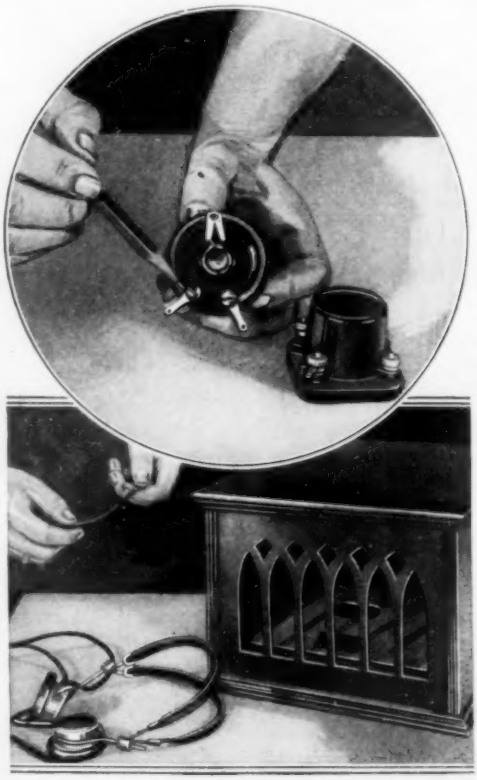
Locating Broken Connections; Inset, Inspecting and Cleaning Terminals and Joints



A Pipe Cleaner Provides the Best Cleaner for Variable-Condenser Plates

can then be located while the set is in actual use by tapping or moving each joint in turn and listening for noises in the headphones.

Dust and dirt are also enemies of good reception as they permit moisture to accumulate and introduce leakage causing troublesome noises. This is especially true in the variable condensers, where dust will gather between the plates; it can be easily removed with a pipe cleaner, used in the manner shown in the photo. If these instruments are of the type provided with wiping connections on the shaft, the points of contact should be well cleaned with a bit of fine emery cloth. If the connections are of the pigtail or flexible type, make sure that they are not broken and that they make good contact. Go over all binding posts and see that they are tight. The rheostats are very important to good operation; examine the terminal connections, and, if corroded, remove the leads, place lugs under the terminals and resolder the connections. Another important point is the contact of the wiping arm on the resistance winding of the rheostat. If this arm does not make good contact at all points on the wire, poor results are certain; if not, remove the setscrew, bend the arm slightly and replace on the shaft.



Lugs on Rheostats and Sockets Must Be Tight and Clean; Below, Inspecting Phone and Speaker Cords

Phone and loud-speaker cords in average service should be renewed once a year as the constant twisting of these cords breaks the fine tinsel conductor and causes noises. They are not expensive and are easily replaced.

Good tubes are all-important; if they have been in use for some time, they should be tested. Some will be found much better than others, and the poor ones can usually be rejuvenated, if they are of the standard type, such as the UV-201A or C-301A; this also applies to the UV-199 and the C-299 types. A good tube has an average life of about 1,000 hours, but when excessive filament voltage is applied, the strain is pushed beyond safe limits, and the tube becomes sluggish or paralyzed. No change can be noted by ocular inspection; the tube still lights, but it fails to produce the results obtained before.

Another important point that should not be neglected is examination of the tube prongs. Each should be cleaned with fine emery cloth to make certain of a good electrical contact with the spring clips in the socket. Inspect also the end of each prong, to make sure that the soldered tip is secure. Before placing the tubes back in the sockets, see that the spring clips in the sockets are tight; if loose, the socket may have to be removed and the screws holding these springs tightened with a screwdriver. After you have gone over the set thoroughly, turn your attention to the aerial and ground.

No set will work well on a poor aerial and inefficient ground. The superheterodyne and other types of receivers using loop aerials are practically free from trouble of this nature, unless there is a loose connection, but with the outdoor type of aerial conditions are different. Summer storms may have rendered the aerial ineffective; it may be touching the building, the wire may be broken; lead-in wires may have rubbed against the building, damaging the insulation and causing shorts, especially during damp weather. If the aerial was installed temporarily, it may be that the connections were made without soldering and corrosion has taken place. Solder the connections at the insulators and at the point where the lead-in wire is connected to the main wire. It is best to make a new joint, first carefully scraping all corrosion from the wire. After the joint has been soldered, wrap it with electrical friction tape. This will insure a good electrical connection that will not be affected by the weather. If the aerial has sagged, this slack should be taken up, as a swinging aerial will give poor results and increase the chances for shorts against the building. Inspect the lead-in to the set and see that it is well insulated and in good condition. No. 14 weather-proofed copper wire makes a very good lead-in and should run as directly as possible to the point where it is taken into the building.

The Wiping Arm on the Rheostat Must Make Good Contact with the Winding

Above, Inspect Tubes for Loose Prongs; Below, See That the Socket Contacts Are Tight

The best ground is obtained on a cold-water pipe, the pipe being filed bright and the wire securely fastened to it by means of a ground clamp. Even if this was done when the set was first installed, it is a good idea to remove the clamp and brighten it on the inside with emery cloth, polishing also the contact surface on the pipe before replacing the clamp. If a water-pipe is not handy, a good ground can be obtained by driving a length of pipe into the soil outside of the building; select a damp spot at a point near the window closest to the set, and fasten the clamp to this pipe. Iron rod can be used if pipe is not available. More elaborate grounds can be obtained by burying metal sheets, or if the aerial is of the overhead type and it is possible to use a counterpoise consisting of several wires strung below the aerial, even better results can be obtained. An approved lightning arrester should be used with all types of outside aerials, and it is necessary to use well-insulated wire run through porcelain-tube insulators where the wire enters the building, continuing this wire to the set. Do not run outside aerials near high-tension wires. If such wires are near the building, run the aerial at right angles to them in all cases. Many humming noises and crackling sounds are attributed to the set which are really caused

by induction from near-by high-tension lines that are paralleling the aerial. If there are other aerial wires on the building, do not run your aerial close to them. Keep as far away as possible, and at right angles, if there is room, above or below them. Use good materials; this is important and will always give better satisfaction in the long run. A well-installed aerial and ground need little attention and pay big dividends in good results.

These things take little longer to do than the time required to tell about them, and the fan who has done them can go ahead with his "DXing" assured that his only enemy will be static.

Take the Slack Out of the Antenna, and See That the Lead-In Is in Good Condition; Inserts, Soldering and Taping Aerial Joints

Finishing a Homemade Loud Speaker

Although it may be very efficient, the average homemade speaker is a bit unfinished in appearance. If made of metal, cardboard or wood it can be very attractively finished by using either the clipped-wool or the blistered effect so often seen. The latter is a little easier to keep clean.

To make the blistered effect, a glue and whiting "dope" is used. This dope is made in the following way: First mix 10 parts of finest gilders' whiting with cold water until a thick cream is formed; to this, add 6 parts of liquid glue. In another container, white damar turpentine varnish, 1 part, is mixed with 4 parts of raw linseed oil. The two parts are then mixed and cooked 10 minutes in a double cooker. When cool, the mixture should have the consistency of very soft butter. Pour this into a wide-mouthed jar and use the following day. This dope is the old foundation for polychrome work and works better after standing for a day.

The speaker should first be given a thorough application of shellac; uncovered spots will not hold the polychrome dope.

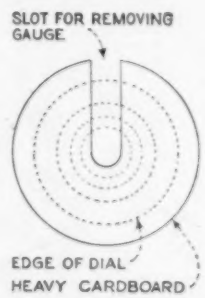
The dope, if of the right consistency, will flow from the brush. If it is too thick, add water drop by drop, and if it is too thin, set the jar, with the lid off, in hot water to evaporate some liquid.

Spread the dope over the speaker with a spatula or broad soft brush. It is best to do one side at a time, as it is a pretty sticky job. Go over the inside surface with a tapping motion. This must be done until the surface assumes a blistered effect. The coating should be allowed to dry for two or three days and the outside is then treated. After drying another three days, the whole surface is given a coat of shellac. For the final finish the speaker may be given two or three coats of colored varnish or of flat paint, to match the interior of the room.

The clipped-wool finish is a little easier and more quickly done. The speaker is first given a coat of shellac and, when dry, is given a rather heavy coat of turpentine damar varnish on the inside. This is a very sticky job. While still very wet, sift on the varnish sign painters' flock. Apply the flock until the surface is evenly covered. This will give a velvety surface that is very good. When perfectly dry, finish the outside of the trumpet in the same manner. If the soft finish is not wanted, a semi-glossy effect can be had by painting over with a thin varnish, after the varnish holding the flock has dried. Do not attempt to hurry the work.

Spacing Dials from Panel

A simple form for spacing the dial from the panel when assembling the set, aids the builder to maintain an equal distance between the dial and panel, at all points. This gauge is made from heavy cardboard and should be large enough to extend about ½ in. beyond the edge of the dial. A slot is then cut to fit around the shaft of the condenser, coupler or variometer, as the case may be. Place the gauge on the shaft next to the panel, and then fit the dial against the form and tighten the setscrew. Then pull out the cardboard. By using this method all dials will be correctly spaced, and will not rub against the panel when rotated.—H. Ray Eaton, Pittsfield, Mass.



Simple Insulator and Mounting for Inside Aerial

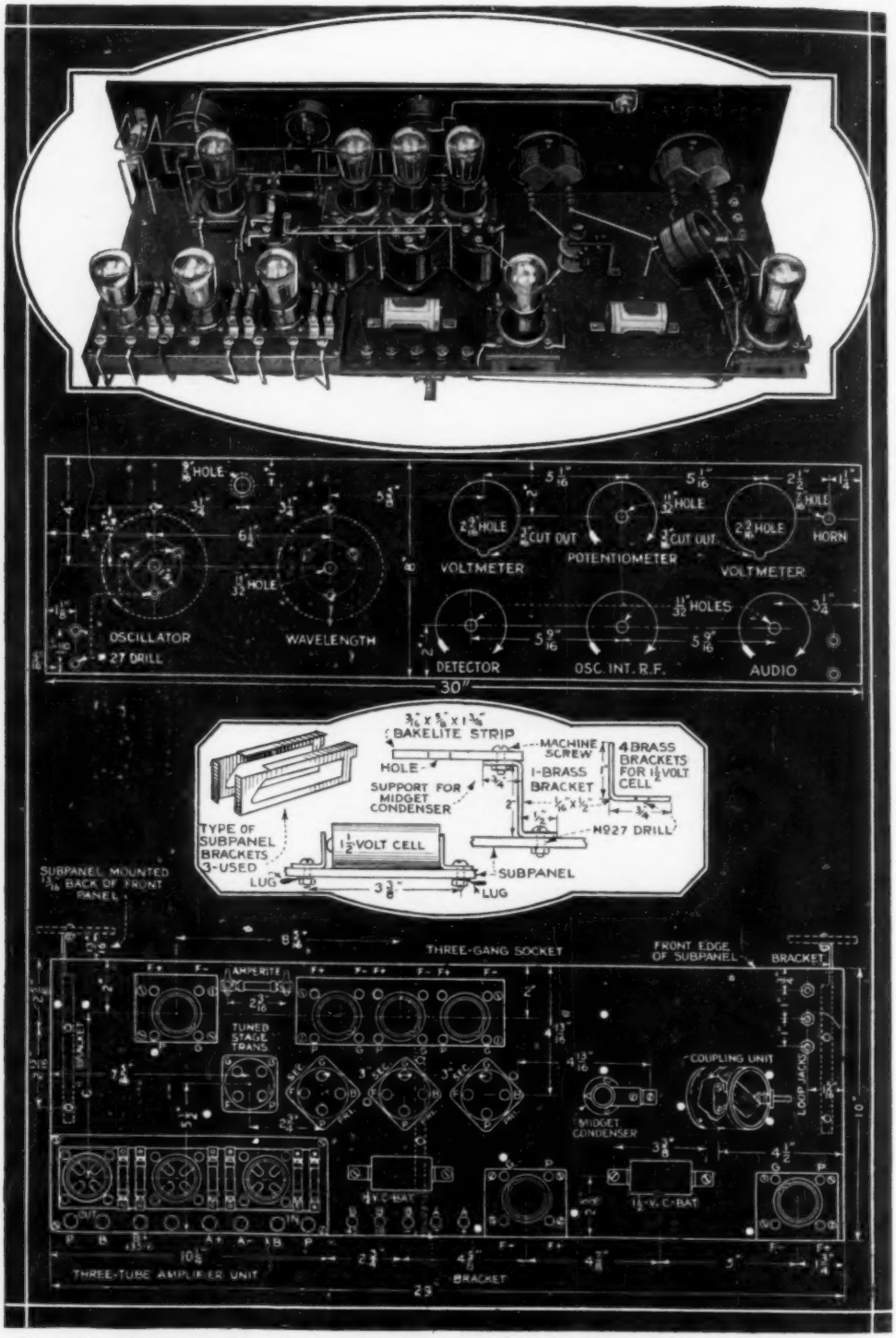
An easily made and efficient insulator for the indoor antenna is shown in the illustration. A short length of ebonite or

Simple Indoor Aerial Supported by Ebonite Rods; Lower Right, Detail of Construction

bakelite rod is filed flat at the ends; next, holes are drilled through its center and slanting slots sawed from the outside to the holes on what will be the inside when mounted, as shown in the detail. The edges of the slots are rounded so that the wire will not bend at sharp angles.

As distance pieces between the wall and the rod, porcelain insulators of the common commercial type are used. The latter should be long enough to keep the wire several inches from the wall, the mounting screws passing through the ends of the ebonite rod and the insulators. A triangular aerial, as shown in the illustration, uses a minimum number of insulators, and gives the greatest length of aerial wire. In addition, such an aerial is non-directional, and receives equally well from all directions. The aerial should be kept about one foot below the ceiling, or even more if it can be arranged.—C. A. Oldroyd, Barrow-in-Furness, Eng.

¶A wavelength of only 6 ft. has been used by station FL, Eiffel tower, France, successfully over a distance of two miles. The antenna current used did not exceed 30 milliamperes. It was found that these short wavelengths were free from static disturbances.



Above, Rear View of the Completed Set, Ready for the Cabinet; Below, Front and Subpanel Layouts and Details of Brackets

Great Range, Ease in Tuning and Simplicity of Construction Also Feature 1926 Model Set

By F. L. BRITTIN

THE instrument described in this article is a further development of the well-known Popular Mechanics' Superheterodyne Eight, which has given real satisfaction to thousands of fans both in this country and abroad. Practically all the parts are the same, but the circuit has been greatly improved, and a resistance-coupled amplifier replaces the a.f. transformers, resulting in even better tonal qualities. The new model sets a standard for volume, range, tone and selectivity that will be difficult to surpass for some time, and gives the broadcast listener a new conception of what receivers should be.

Simplicity of design makes the new set especially interesting to those with limited experience. The front panel and subpanel are larger than in the former set, providing ample room for the instruments, which are so arranged that shielding is unnecessary. Before attempting to build the instrument, look over the diagrams carefully and provide all parts just as specified in the material list; take time to do good work and follow the instructions in the order they are given.

The layout for the subpanel is given at the bottom of the opposite page. Place this panel on the table and arrange the instruments in the positions shown in the diagram, with all terminals exactly as indicated; then, holding each instrument firmly in place on the panel, point off each mounting hole with an icepick or other sharp instrument, and before removing the sockets and other instruments from the panel, point off the holes indicated by the white dots. These holes are required for running the leads below the subpanel and only the most important points are indicated, as the other holes can be drilled later, as required. Point off the holes for the mounting brackets and other instruments carefully. All holes in this panel then can be drilled with a No. 27 drill except the three holes for the loop jacks where ⅜-in. holes are required. The subpanel brackets are a standard type that can be obtained from any dealer; these raise the subpanel 2 in. and permit easy wiring under it, resulting in short direct leads. Three brackets are used, one at each end and one reversed and mounted in the center of the panel at the rear. The flat ends of the two end brackets, in which screw holes will be noted, are mounted toward the front and extend 1 3/16 in. beyond the panel; each of these brackets is ⅝ in. from each end of the panel. The center bracket at the rear is mounted with the flat end flush with the rear edge of the panel. Round-head brass machine screws, 6-32 by ½ in., are used to mount the brackets, as well as for most of the other instruments; screws 1½ in. long will be necessary for the tube sockets and the amplifier unit.

The bracket for mounting the midget condenser is shown in detail in the diagram, also the four small brackets used for mounting the 1½-volt dry cells; these brackets are all made from a 10¼-in. strip of 1/16-in. brass ½ in. wide. The brackets for the 1½-volt cells are mounted 3⅜ in. apart and are bent so as to hold the cell tightly in place and make good contact on the cell base and the brass positive terminal at the opposite end. Refer now to the large wiring diagram, and mark these brackets positive and negative in their proper order, so that there will be no error later. The amperite unit, mounted between the second detector and the three-gang socket, is an automatic filament control for the second detector tube, and eliminates a rheostat at this point. The .00025-mfd. condenser is mounted on the metal brackets supplied with the tuned-stage transformer and placed across the secondary terminals; a similar bracket is supplied for the .0005-mfd. grid condenser, which also carries the gridleak in clips; this bracket is mounted on the grid terminal. The A and B-battery binding

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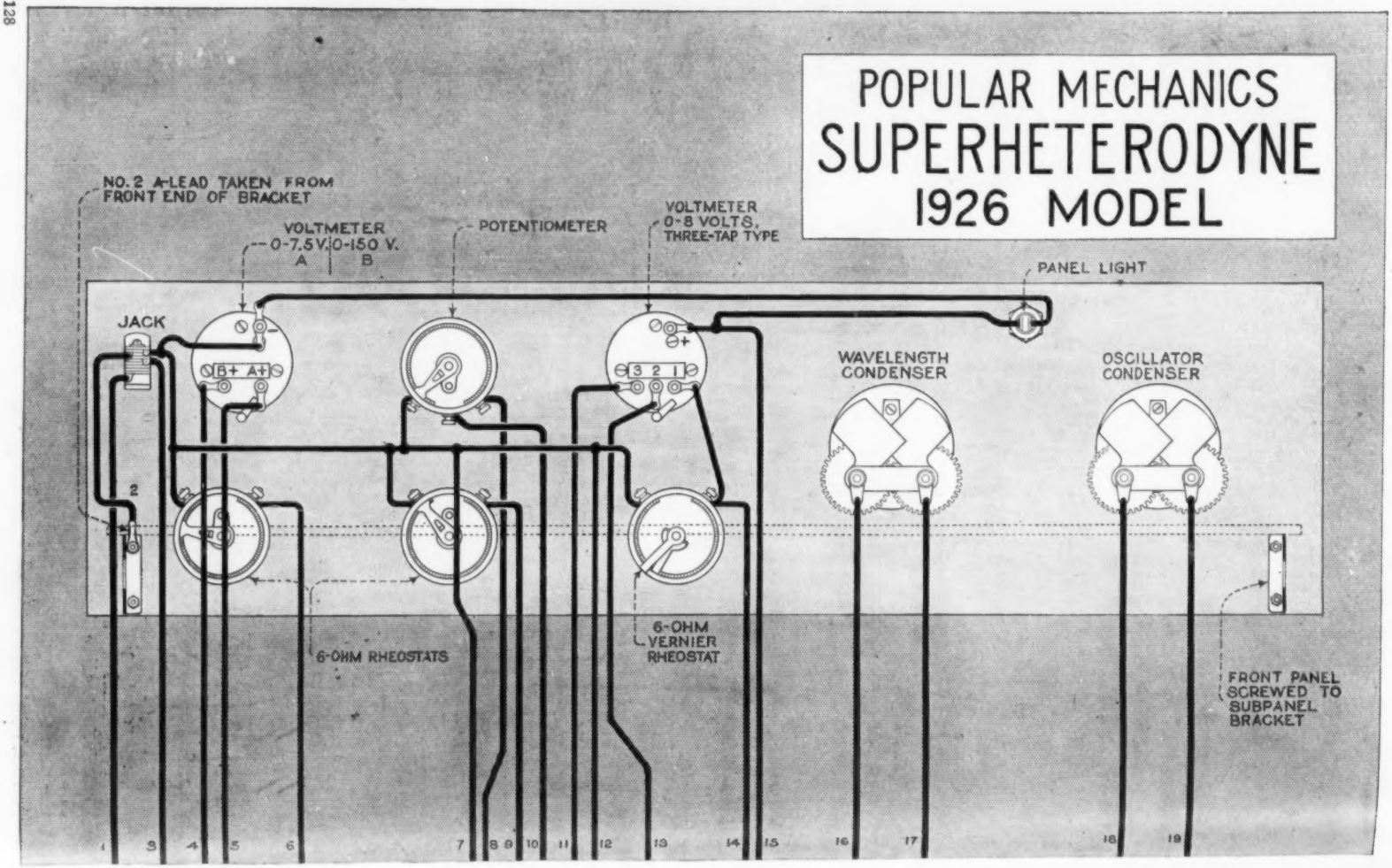
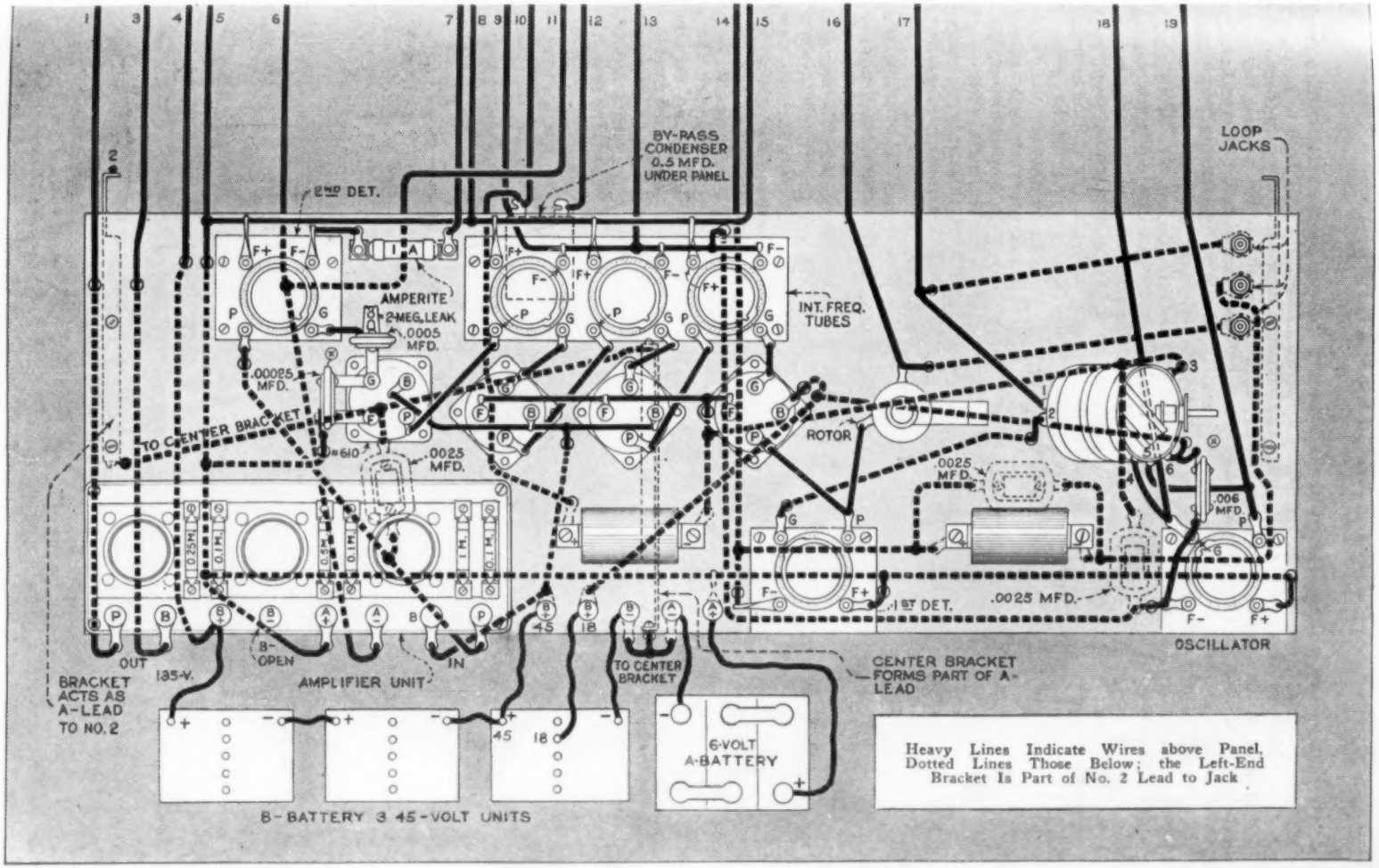
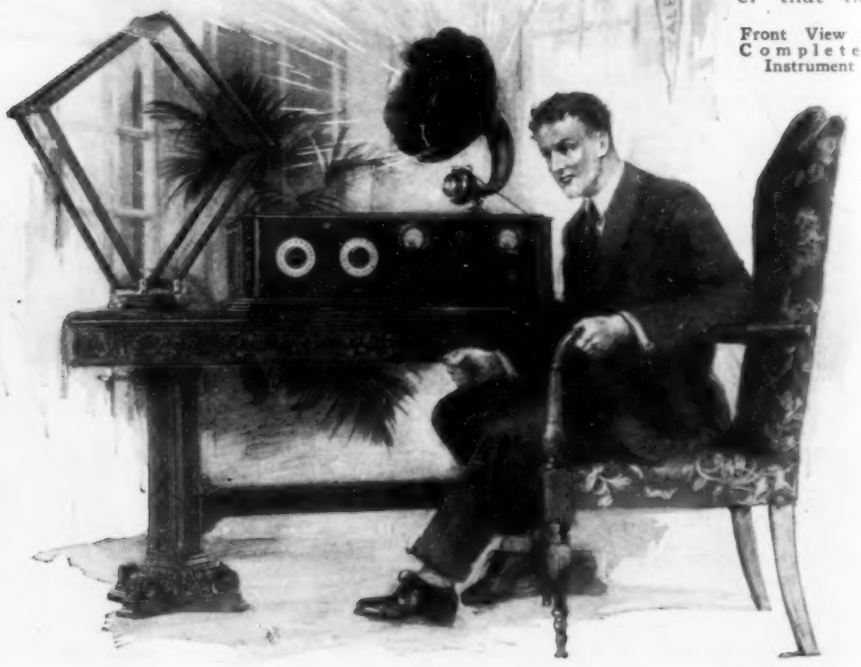

POPULAR MECHANICS
SUPERHETERODYNE
1926 MODEL
NO. 2 A-LEAD TAKEN FROM FRONT END OF BRACKET
VOLTMETER 0-7.5 V. 0-150 V. A B
POTENTIOMETER
VOLTMETER 0-8 VOLTS, THREE-TAP TYPE
PANEL LIGHT
JACK
B+ A+
3 2 1
WAVELENGTH CONDENSER
OSCILLATOR CONDENSER
6-OHM RHEOSTATS
6-OHM VERNIER RHEOSTAT
FRONT PANEL SCREWED TO SUBPANEL BRACKET
1 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19


BY-PASS CONDENSER 0.5 MFD. UNDER PANEL
LOOP JACKS
2ND DET.
AMPERITE
2 MEG. LEAK
.0005 MFD.
.00025 MFD.
INT. FREQ. TUBES
TO CENTER BRACKET
610
.0025 MFD.
ROTOR
.0025 MFD.
.006 MFD.
1ST DET.
.0025 MFD.
OSCILLATOR
BRACKET ACTS AS A-LEAD TO NO. 2
OUT
135-V.
B-OPEN
AMPLIFIER UNIT
IN
TO CENTER BRACKET
CENTER BRACKET FORMS PART OF A-LEAD
6-VOLT A-BATTERY
B-BATTERY 3 45-VOLT UNITS
Heavy Lines Indicate Wires above Panel, Dotted Lines Those Below; the Left-End Bracket Is Part of No. 2 Lead to Jack

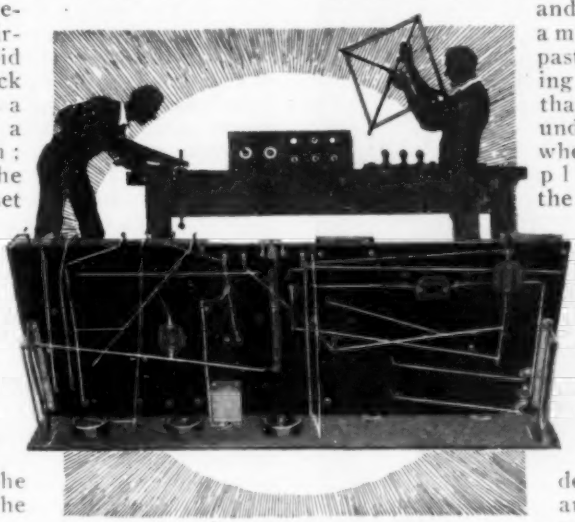
posts are mounted on the subpanel in the order shown. Mark the 18 and 45-volt B-posts for identification; the other posts can be had with engraved tops. The three-tube amplifier unit is complete and greatly simplifies the wiring; the terminals are plainly marked so there is little chance for error.

All dimensions for the front panel are plainly shown. This panel should be laid out with care, and it is best to prepare a cardboard template the exact size of the panel. Clamp this to the panel with two or more C-clamps and point off the holes to be drilled carefully, marking the panel deeply so that the drill will not creep and throw the hole out of line. Countersink the holes marked with double circles. For the larger holes, it may be necessary to take the panel to a machine shop, especially for the voltmeter holes. The front of the panel is shown in the template so it is necessary to refer to the double-page wiring diagram for the rear view of this panel with the instruments mounted in their respective positions. The dotted line indicates the height of the subpanel when the front panel is mounted on the brackets, there being sufficient space between the two panels to clear the rheostats. The panel light is placed above and between the condensers, serving as a reminder that the



Front View of Completed Instrument

tubes are lighted and also as a tuning light for the dials, which is useful at times. The horn jack shown in the upper left-hand corner is detailed in one of the illustrations, and each spring in it is numbered to correspond with the circuit wires to avoid error. This jack functions both as a horn jack and a filament switch; plugging in the horn places the set in operation, and to shut the set off, the plug must be withdrawn, which is a further check on the operator to remind him not to leave the set turned on, needlessly using the batteries when the set is left alone.



View of Underside of Panel; Note the Position of the Condensers

This, of course, puts all the tubes in use at once, but volume can be controlled with vernier detector rheostat, if a UV-200 or C-300 tube is used for the first detector, or practically the same result can be had by detuning, if a UV-201A or C-301A tube is used. All other tubes are of the A-type. For those who prefer to operate the set at times with a minimum number of tubes, a simple switching device that can easily be mounted on the front panel will be described in an early issue. The set is now ready for wiring.

The wiring diagram is as simple as it is possible to make it, and all wires are shown in their exact positions both above and below the subpanel, the panels being separated to show the wiring more clearly. The wires are numbered so that each lead can be easily traced from page to page; the black lines indicate the wires above the subpanel and the dotted lines show the position of the wires below. Wire No. 4, running from the B-positive 135-volt terminal on the amplifier unit to the B-positive terminal on the A and B-battery voltmeter, is a flexible rubber-covered lead, No. 14 round tinned-copper busbar wire being used for the remainder of the circuit. Very little spaghetti insulation is used; only a few short lengths are necessary under the subpanel where wires are likely to be shorted if moved out of place. Soldering lugs are used under every terminal where a wire is to be connected. The lugs are fastened to the small fixed condensers with short brass machine screws. Lugs are very important; do not fail to employ them, and use solid wire solder and a very small amount of flux paste, carefully wiping the flux off so that it will not run under the terminal when the iron is applied. Note how the wires are run from the instruments on the subpanel down through holes and continuing to their respective terminals. Do not change the direction of these leads under the panel; they are so placed as to avoid forming loops in the circuit, which would cause detrimental effects in the set. Several by-pass condensers are mounted below the subpanel, and are indicated by the dotted lines; these condensers are clearly shown in the under-panel photo. Note that the .5-mfd. by-pass condenser is mounted on the underside at the front by means of two short brass machine screws, the soldering terminals extending just beyond the edge of the panel. Now, mount the front panel on the subpanel brackets, place a soldering lug under the nut at the point marked for wire No. 2. This is for the A-negative lead, of which the left-end bracket and the center bracket are a part. Soldering lugs are mounted on the ends of the brackets with short brass machine screws, and the dotted line clearly shows the lead connecting the brackets. The A-negative and B-negative binding posts are connected to each other and then to a lug mounted on the rear end of the center bracket. The 2-in. space below the subpanel provides ample room for all wires without crowding, and leads crossing each other can be well separated. Note the lead running from the negative of the 1½-volt cell to the center loop jack; the center loop lead will be plugged into this jack when the set is hooked up for operation. The A and B-batteries and their connections are so clearly shown that little explanation is

necessary. The B-batteries should be of the large 45-volt type, and are connected in series to obtain a total of 135 volts for

Side View of Jack, with Springs Numbered to Correspond to Diagram

the amplifier unit, the 18 and 45-volt taps being taken from the first 45-volt unit as shown. Note that the B-negative post on the amplifier unit has no connection. The loop may be of any good make, but must be provided with a center lead. Flexible, well-insulated leads not over 3 ft. long—shorter if possible—are connected to the loop. These leads terminate in small plugs of the cord-tip type, and are plugged into the loop jacks, the center lead to the center jack. Plug in the horn and place one tube successively in each socket, after connecting the batteries, turning up the rheostats to see that the filament circuit is correctly wired. Facing the set, the audio rheostat is the one on the extreme right; it controls the filament voltage for the amplifier tubes only. This voltage can be checked by point 3 on the three-tap voltmeter. The second detector tube is automatically controlled by the amperite, and the center rheostat is for the oscillator tube and three intermediate-frequency tubes in the three-gang socket; this voltage is checked on point 2 of the voltmeter. The first detector tube is controlled by the vernier rheostat and is checked at point 1 on the voltmeter. After testing the filament circuit, place all of the tubes in the sockets, and the set is ready for operation.

Operating a superheterodyne receiver correctly, so as to obtain maximum results, requires a little practice. This is true of any highly developed instrument—the experienced operator has the advantage; however, the operation of the instrument is so simple that anyone can soon tune in stations at surprising distances with good tone and volume. Set the rotor of the coupling unit at an angle of about 45°, and the set can be adjusted under operating conditions. Set the pointer knobs of all rheostats so that the rheostat is at the off position when turned to the extreme left. A small setscrew in the knob is then tightened on the shaft, and the pointer on the potentiometer knob is fastened in the same manner. To tune in a station, first set the potentiometer about one quarter of the way up from the lower-left side, then turn up the rheostats slowly, keeping the pointers at approximately the same position, and continue until you hear a soft hum from the tubes. Second, set the wavelength condenser at any given point, say 30°, and rotate the dial of the oscillator condenser very slowly 10 to 15° on each side of the 30° mark; if a click or whistle, indicating the presence of waves from a station, is heard, but the words or music is not clear, turn up the detector rheostat slightly, or shift the potentiometer either forward or back, to clear the signal. The potentiometer will have a certain setting where all stations come in best, this point always being found to the left of center. The rheostats will also have a more or less fixed setting that will give the best results, and the tuning is then almost entirely confined to the condenser dials. Third, if nothing is picked up at the first setting of the condensers, move the wavelength condenser up 10°, and again rotate the oscillator dial slowly as before on either side of the 40° mark, continuing this process until a station is picked up. Shift the position of the loop from time to time, as this will often enable stations to be picked up that otherwise would not be heard. When a distant station is picked up and tuned in to best advantage, set the little midget condenser to the point where the signals come in with the best volume and clarity; also make any slight adjustment of the coupling unit rotor that may be necessary to get the loosest coupling without approaching the breaking-over point too closely.

These last-mentioned adjustments need only be made once, and best results are

obtained if they are left alone after the proper setting is once determined.

Place the set in a cabinet or console having a depth of 12 in. measured from the front panel to the rear partition, drilling holes through the rear of the cabinet for the loop and battery leads; bore the holes for the leads about 1 in. apart. Use heavy, flexible rubber-covered auto-ignition wire for the A-battery leads, and lighter flexible well-insulated leads for the B-batteries.

A complete set of large blueprints, including full-size panel and subpanel drilling templates, instrument layout, and wiring diagram, as well as a schematic diagram of the circuit, may be obtained from the Radio department, Popular Mechanics Magazine, 200 E. Ontario st., Chicago, for 75 cents. Specify blueprint No. 104.

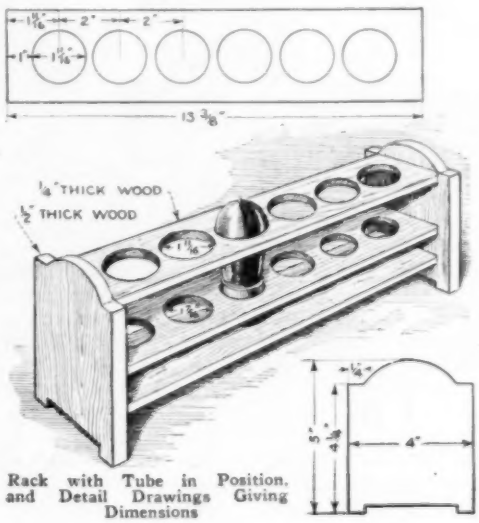
MATERIAL LIST

1 bakelite or formica panel, 3-16 by 8 by 30 in.
1 bakelite or formica subpanel, 3-16 by 10 by 29 in.
1 bakelite strip, 3-16 by ⅝ by 1⅞ in.
1 brass strip, 1-16 by ½ in., 10¼ in. long.
3 Benjamin subpanel brackets.
3 No. 600 Remler intermediate-frequency transformers.
1 No. 610 Remler tuned-stage transformer.
1 No. 620 Remler coupling unit.
2 No. 631 Remler .0005-mfd. capacity unit, complete with dials.
1 three-gang, shock-absorber type socket unit, standard base.
3 single shock-absorber type sockets, standard base.
2 6-ohm rheostats, plain, one-hole mounting.
1 6-ohm rheostat, vernier, one-hole mounting.
1 400-ohm potentiometer, one-hole mounting.
1 filament-control jack.
1 1-A amperite.
1 No. 855 Chelton midget condenser, low-loss.
1 Daven super-amplifier unit complete (three-stage).
1 No. 55 Jewell voltmeter, 0 to 8 volts only, three-tap type.
1 No. 55 Jewell voltmeter, A and B-type, 0 to 7.5; 0 to 150 volts.
1 loop aerial, three-tap, (box-type preferred).
1 panel light.
1 2-meg. gridleak, cartridge type.
1 Sangamo condenser, .0005 mfd., with gridleak clips.
3 Sangamo condensers, .0025 mfd.
1 Sangamo condenser, .006 mfd.
1 Sangamo condenser, .00025 mfd.
1 Dubilier by-pass condenser, 0.5 mfd.
2 1½-volt dry cells (large size).
5 binding posts with engraved tops.
3 cord-tip jacks and plugs.

Handy Rack for Spare Tubes

Many good radio tubes have been ruined for lack of a safe place to keep them, and the simply constructed rack described herewith is therefore a worthwhile addition to the experimenter's equipment, and should be used even if the tubes are removed from a set for a few moments only. Anyone can make the rack at very little cost. Three pieces of hardwood, ¼ in. thick, 12 in. long and 3 in. wide, are required for the shelves. The position of these is shown in the drawing. The lower shelf serves as a support for the tube base, while the two upper ones are perforated to hold the bulbs snugly in an upright position. The holes in the top shelf are 1 1/16 in. in diameter, and those in the one below, 1 7/16 in. in diameter. Be sure the holes are spaced properly so that they will line up when the rack is assembled.

The two endpieces are of ½-in. stock; these should be 4 in. wide and 5 in. high at the highest point, the rounded top improving the appearance of the rack. These pieces may be grooved to take the shelves, which are then glued and tacked in place with small brads, or the shelves may be tacked directly to the ends, if preferred. After the rack is assembled, it should be sandpapered and varnished. It is a good plan to screw the rack to the table.—C. A. Reberger, Roselle Park, N. J.

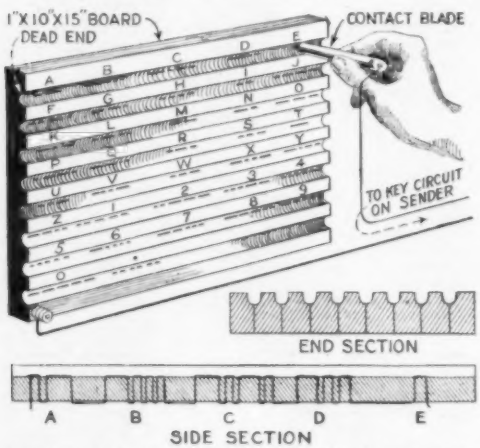


Rack with Tube in Position, and Detail Drawings Giving Dimensions

¶The tone of incoming signals can be improved considerably by shunting the primary of the first audio-frequency amplifying transformer with a fixed condenser of .001 mfd. capacity.

Making a Wireless-Signal Board for Code Practice

A radio-signal board for the beginner who is learning the code will prove a great help. With it, the necessity for listening



Wireless Code Board Which Transmits Signals Automatically; the Construction Is Clearly Shown

in is eliminated, and the speed can be regulated to suit the operator. A device of this type was used years ago by telegraph operators, and the one described is a simplified form of this, which will meet the need of the radio amateur. It can be used instead of a key for sending messages if desired, or connected to a buzzer for code practice.

Use a board, 15 in. long, 10 in. wide and 1 in. thick, preferably of oak or ash. Lay off eight parallel grooves, the long way of the board, with a round-nose gouge. The end section given in the illustration shows the relative depth of these grooves. The spaces between them should be a little wider than the grooves themselves. The wireless signals are made up of dots and dashes, so the idea is to arrange long and short metal contacts in the grooves to correspond with the individual code signals. This is done by threading soft copper wire through the board as indicated. For this purpose, mark off the dots and dashes in the grooves. Five characters to a line will be about right; then mark the character itself in ink above the groove. Thus A, B, C, D and E will be written along the top of the board, and the corresponding characters will be drawn in pencil in the groove below them.

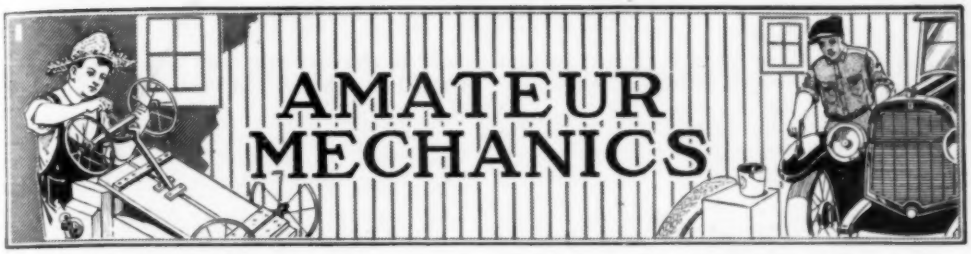
Now, with a small drill, bore vertically through the wood at the ends of each dash and dot, being careful to keep the holes apart through their entire depth. The board is now ready for wiring. Starting at A, push the end of the wire up through the first hole from the bottom and down through the second. This makes a short line or dot. Then push the wire up again in the next hole and down through the following. This makes a dash, and with the previous dot forms the code signal for the letter "A." Continue this threading process throughout the entire board, pulling the wire taut at all times and flatting it in the grooves with a dull tool. The end of the wire should come out at the lower left-hand corner of the board where it is fastened to a binding post. The end started at A should be left open, or dead. Remember to use one continuous wire throughout.

Connect the binding post to one side of the key or buzzer, and the other wire from the circuit to a dull-edged piece of metal, called the contact blade, which should slide freely in the grooves. It should also be insulated for part of its length to form a finger hold for the operator. With the circuit ready for sending, simply draw the blade slowly across the contacts under the letter to be transmitted. Its longer or shorter contact with the wire in the groove means a dot or a dash, automatically sending the letters.

Adjustable Resistance Unit Replaces Amplifier Rheostats

A simple adjustable resistance unit that can be used instead of rheostats mounted on the panel is now available. It simplifies the operation of the set by eliminating panel-controlled rheostats, and being mounted upright on the filament post of the tube socket, as shown in the illustration, takes very little space. The upper view shows the unit in detail. The adjustment can be instantly changed to suit any tube, the resistance ranging from .2 to 35 ohms.

A pair of electrician's tweezers are a convenience in keeping the tops of storage batteries dry, when used with cotton batting and weak ammonia. They are especially useful when cleaning under the lugs of B-batteries.



Building a Monorail Coaster

By L. B. ROBBINS

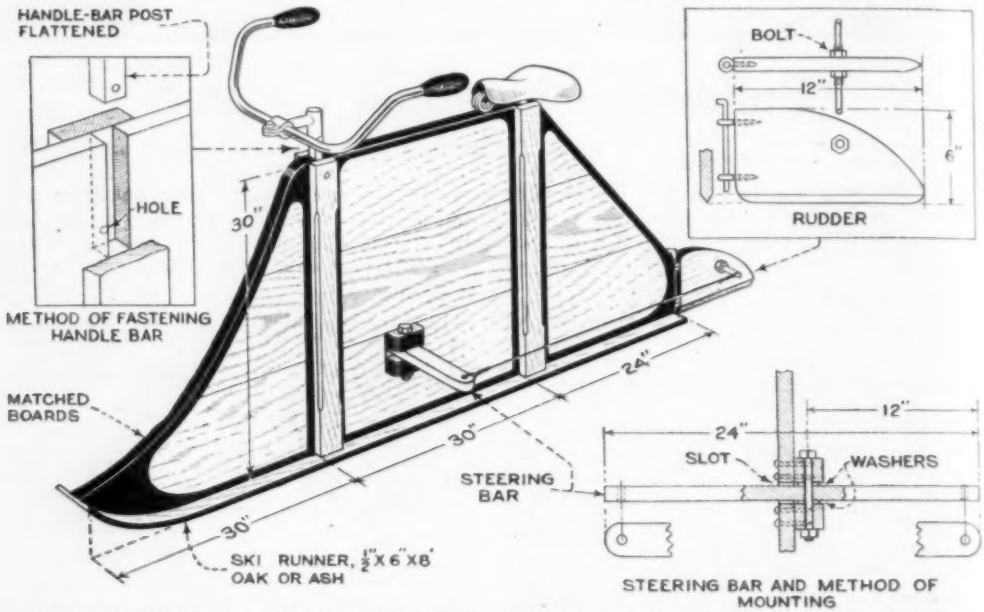
HERE is a winter coasting device that is a sort of combination ski and bicycle. It is used for running down long, smooth snow-covered hills and will afford much fun for the lover of speed.

The body of the coaster is made by cleating together several smooth, matched spruce boards, 7 ft. long. Their width is immaterial but the total width should be about 30 in. First put on the two back cleats, one on each side, with screws. Place these at right angles to the edges and 24 in. from one end. Let these two cleats project beyond the top edge about 3 in.

Now, 30 in. ahead of these cleats, saw a vertical notch down through the top board, for a depth of about 6 in., and make it 1 in. wide. This is for the handlebar post. Then screw two cleats over the boards at this point so as to completely cover the notch. Be sure to draw the boards well together before cleating and to countersink the screw heads. Then saw the rear ends of the boards off at an angle, as shown, so the last 8 in. of the rear will be vertical. Also cut out the front in a sweeping curve, as shown, commencing just in front of the forward cleats and ending it 8 in. from the bottom. The bottom should then be curved down in a sweep to its long straight edge.

The ski runner had best be made from a piece of oak or ash, 8 ft. long, 6 in. wide

and ½ in. thick. Fasten it to the bottom edge of the body with brass screws, countersinking the heads only slightly. The back end should be flush with rear of the body, but the front end should project up and beyond the point. This curve is easily obtained if the wood is steamed or soaked in boiling water before attempting to fasten in place. Sandpaper the runner smooth and oil with linseed oil.



Construction Details of the Coaster; the Handlebars and Saddle of an Old Bicycle Are Used and a Foot-Steering Arrangement Is Provided

The handlebars can be taken from an old bicycle. Flatten the post so it will fit down in the notch in the body and drill a hole through it and corresponding holes through the cleats for a retaining bolt, to hold it steady. The seat may also be an old bicycle saddle and can be bolted to the top between the two rear cleats, as shown. The saddle type used will determine how this should be done.

Then comes the steering arrangement. This consists of an iron bar 24 in. long, 2 in. wide and stiff enough to stand your weight. Have a pivot hole drilled 11 in. from one end and a small hole in each end for the steering cables. Cut a horizontal slot in the body, 10 in. from the bottom, and at a point between the cleats convenient to the feet when sitting in the saddle. Bolt two hardwood blocks above and below this slot and drill a hole down through them. This is a pivot hole for a long bolt, which should be driven down through the blocks and through the pivot hole in the steering bar. Be sure to have the 11-in. end of the bar on the blocked side of the body.

The rudder is cut out of a piece of hardwood, 12 in. long and 6 in. wide, to the shape shown in the detail. Sharpen the bottom edge and fasten a long bolt through the middle, near the top edge. Drive a pair of heavy screweyes into the vertical edge of the rudder to fit close to another pair in the end of the body. A steel pin, run through the screweyes, allows the rudder to swing from side to side. Drill a hole in each end of the bolt and connect them to the ends of the steering bar, as shown. Use small steel wire and line the rudder up so it will be exactly in line with the runner when the bar is at right angles to the body.

Give the entire body two or three coats of bright-colored paint, to protect it from moisture and give a sporty appearance.

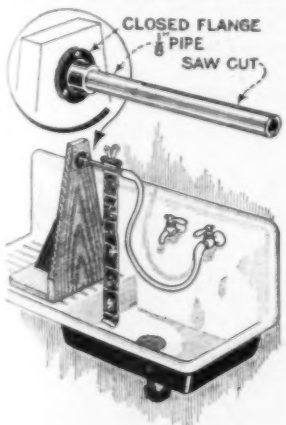
Starting from the crest of a long hill, this monorail coaster is ridden exactly like a bicycle except that the steering is done with the feet on the steering bar. A slight movement either way moves the rudder and changes the course of the coaster. Be careful of attempting to take too sharp curves however. The best speed can be realized by wearing a hard-packed path down the slope by several descents and following this track as closely as possible in all later trips.

Nickelplating by Friction

In nickelplating iron, a thin coating of copper can first be produced on it by rubbing on a solution of 20 parts of sulphate of copper, 5 parts of sulphuric acid and 100 parts of water. After the copper plate has been formed rub over it, with a rag, a solution of 3 parts tin, 6 parts nickel and 1 part iron in 100 parts of hydrochloric acid and 3 parts of sulphuric acid. If finally the object is rubbed with a rag that has been dipped in finely pulverized zinc, a nickel deposit will be made on the copper. The thickness of the nickel deposit can be increased by repeating the two last operations. A silver coating can be produced by dissolving freshly precipitated chloride of silver in a solution of hyposulphite of soda, 1.1 parts to 10 parts of water, and adding to this solution 180 parts spirits of sal ammoniac and then stirring in 800 parts of finely washed chalk. This mixture is applied and rubbed until it dries on the object being silvered, and the result is a brilliant deposit of pure silver.

Holder for Washing Photographic Films

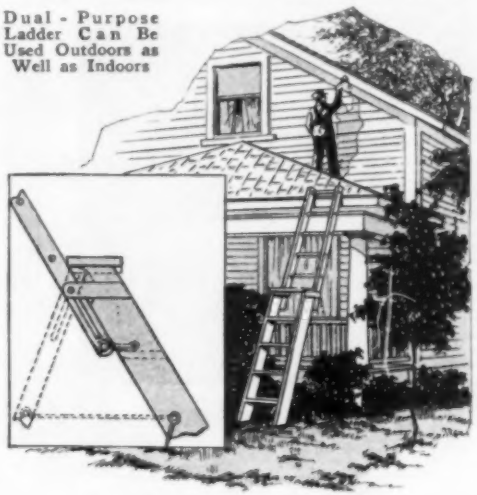
Photographic films can be effectively washed in the sink by means of the simple device shown in the illustration. A short length of ⅛-in. pipe, threaded at one end, a ⅛-in. pipe flange and a section of rubber hose are the only materials needed. With the hacksaw, cut a slot, lengthwise through the pipe, about 1 in. greater than the width of the largest film to be washed, as shown in the detail. Screw the pipe into the flange and fasten this to a wooden standard which should be high enough to permit the film to hang down into the sink without touching the bottom. The film is held with a clip. A length of rubber tubing is slipped onto the water faucet and over the end of the pipe and the water is then allowed to run slowly. It will flow down both sides of the film and clean it thoroughly.—Harold Nowell Whitmore, Cleveland, Ohio.



Folding Stepladder Extension

A stepladder that can be opened up so that it becomes almost twice as long, is a convenient part of the household equipment. As shown in the drawing, half of the ladder is part of an ordinary stepladder, and the second half is simply a short ladder of the usual type. The two sections are joined by means of two metal straps with a rung between them on which the top ladder slides in slots cut in the rails. A hook attached to the lower half is swung out to slip over the bottom rung of the upper half to hold it rigid when extended.—A. C. Cole, Chicago, Ill.

Dual - Purpose Ladder Can Be Used Outdoors as Well as Indoors

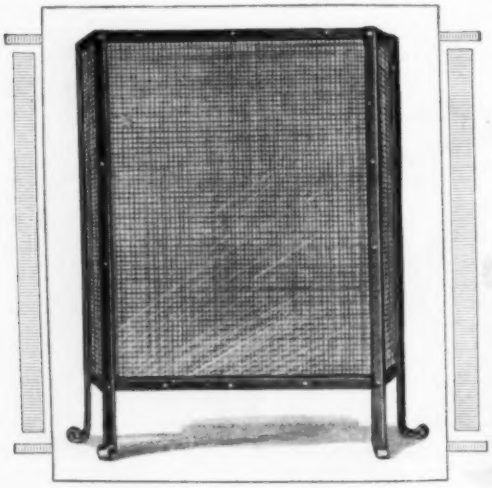


Cleaning Center-Guide Float in Carburetor

Many carburetors are fitted with hollow metal floats having a tube through the center. The inlet needle works in this tube and any roughness or dirt here will cause trouble by too high or too low a fuel level. A good method of cleaning out the inside of the tube is to remove the float and draw a rag soaked in metal polish through it. Repeat this several times and then draw a dry rag through the tube. If the opening is still rough, roll up a piece of very fine sandpaper or emery cloth, insert it in the tube and pull this back and forth until the surface is smooth. Finish by using metal polish on a rag. The inlet needle should also be treated with metal polish. Care should be taken when using sandpaper in the tube through the float, as any holes made here would allow the float to fill with gasoline.—E. T. Gunderson, Jr., Humboldt, Iowa.

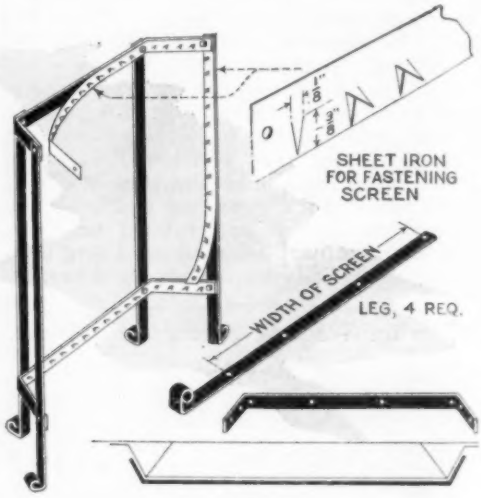
Making a Fireplace Screen

Sparks from fireplaces sometimes set houses afire and frequently cause other



Fireplace Screen Made from Strips of Flat Metal, Sheet Metal and Copper Screen

accidents. This danger could be greatly reduced if fireplaces were protected with screens. These can be purchased or made at home; the one shown in the photo and illustration is simple in construction and can readily be made by anyone who is handy with tools. The frame is made of 3/16 by 3/4-in. bar iron, which can be obtained from a blacksmith or a hardware dealer. With a hacksaw, cut off four lengths for legs, making each leg 4 in. longer than the height required for the frame. Form a foot on one end of each, as shown. This can be done by heating the iron, then clamping it in a vise and bending and hammering it into shape. The legs must, of course, be uniform in shape and dimensions. Drill 1/4-in. holes in each to receive stove bolts with which crosspieces are attached, the length of which is determined by the width of the fireplace. If there is a projecting hood above the opening the screen should be bent to conform to its shape as shown in the lower right-hand detail. In any case it should be bent approximately to the form shown, making the front legs project forward at least 4 in. beyond the rear ones so that the screen will stand securely. Cut strips of 24 or 26-gauge sheet iron about 3/4 in. wide. With tin snips one edge of these strips is cut to form points, as shown. Bend these points up at right angles and attach the strips to the crosspieces and to the end legs as indicated. It is then an easy matter to attach some copper screen by slipping it over these points and then bending the points over. Be sure that the screen is drawn up straight and true. It is held stretched and smooth by 1/2 by 1/8-in. iron bars, cut to fit over the strips of sheet metal holding the screen, holes being drilled through the bars to fit over the stove bolts. The projecting edges of the screen are carefully trimmed off and the rough edges and corners of the metal



strips filed down. — Howard E. Good, Waterville, Ohio.

Copper Stencil for Marking Laundry

A stencil suitable for marking laundry may be easily made as follows: Obtain a small sheet of very thin sheet copper, about 1 in. wide, and 4 in. long. Dip this in a vessel containing some melted beeswax so that both sides will be evenly covered with a thin coat when it cools. The design, name, monogram or figure that is wanted in the stencil should now be drawn upon a piece of thin white paper, the reverse side of the paper blackened with graphite, and then laid on the stencil plate with the design in the center of the plate, whereupon the design is lightly traced with a blunt point on the thin wax coating. After the paper is removed, trace the design on the wax surface with a pointed instrument, but not completely, the lines being broken at more or less regular intervals, to form holders so that, after etching, the design cannot fall out.

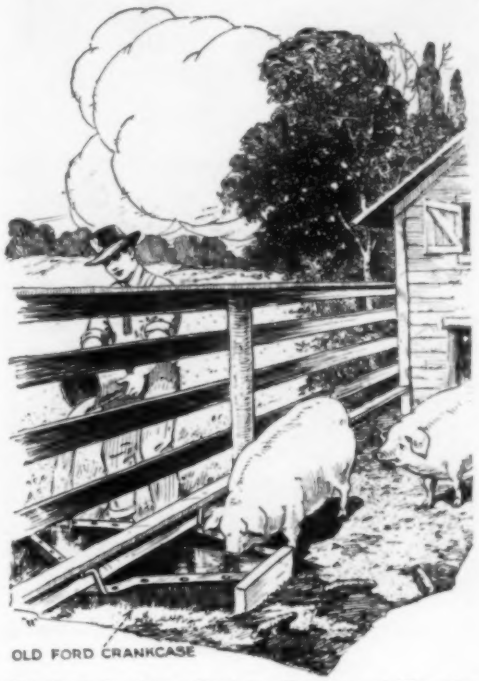
Next lay the stencil in a shallow dish and pour a small quantity of fresh nitric acid over it. Keep the air bubbles removed from the surface of the sheet by means of a piece of soft feather or brush. The design will be eaten out in a very short time where the wax has been removed, and this may be readily observed by holding the stencil plate up to the light. The acid should then be rinsed off with water, and the wax removed by heating and wiping it off with a cloth. The stencil may be given a final cleaning in a dish of benzine or gasoline, which will remove any remaining wax.

Novelty Lampshade Revolves on Stand

A lampshade turned by the heat from the bulb can readily be made for the type of electric lamp in which the bulb is mounted upright at the top of a supporting base. Remove the regular shade and replace it with a special shade made of fairly transparent parchment or colored bond paper. This shade may be made either cylindrical or square. The top of the shade is of cardboard, and is cut so that it has small blades or fans like those of a windmill wheel. The center has a dent punched in it to rest upon the small tip of the bulb. Thus mounted, there is almost no friction and the rising heat from the lamp through the fan blades of the top causes the shade to revolve slowly. Figures can be cut from black paper and pasted to the shade or

Novel Parchment Lampshade Which Is Rotated by Rising Heat from the Lamp

other light ornamentation of the kind shown may be added and will make it quite attractive.



Old Ford Crankcase Used for Feeding and Watering Hogs

Crankcase Makes Hog Trough

Instead of throwing away an old discarded Ford crankcase, one farmer made use of it as a trough for watering and feeding his hogs. A small hole is dug in the ground under the fence to receive the crankcase, the narrow end of which projects outside of the hog yard. This arrangement enables the farmer to pour the slops into the crankcase without spattering it on his clothes or having the pigs rub their snouts against his shoes.

Locating Breaks in Tire Casing

Breaks on the inside of tire casing that are large enough to wear the inner tube, are sometimes difficult to find when the tire is removed from the wheel. It is a good plan to roll the casing by hand on the floor, bearing down on it heavily. This gives the effect of a tire about half down, and causes breaks on the interior to show up plainly inside of the flattened portion. This is a good method to use with small tires, but larger tires are usually too stiff to be flattened in this way.—E. T. Gunderson, Jr., Humboldt, Ia.

When you have a hole in your pocket turn the pocket inside out and cover the hole with adhesive tape.

Operating Heating

Home Plant Will Repay by Reducing Cost

Feed the Coal Properly to the Firebox if Best Results Are to Be Obtained

TO keep the cost of heating the home low, while at the same time keeping the house comfortable, demands that the operator understand his plant. Simply filling the firebox with coal and removing the ashes whenever they accumulate, is not enough. Every owner should learn to regulate his heater so that it will follow the changes in outside temperature, and so that the fuel will be burned efficiently.

The thing that is most neglected about the average plant is the proper use of the dampers. There are usually four on the furnace; the draft damper, the feed-door damper, the check damper and the smoke-pipe damper. The draft damper is generally a small lift door or slide in the ash-pit door, which admits almost all the air that makes the furnace burn. The check damper is usually fitted in an elbow in the smoke pipe, and, by opening this, cold air is admitted to the smoke pipe, reducing the draft in the chimney and slowing up the burning of the fuel in the firebox. This damper should always be closed tight whenever new fuel is added to the fire. The feed-door damper, which is usually a small slide in the door leading to the firebox, is more important than is usually supposed; cold air may be admitted through it directly over the fire and if it is opened wide, it acts as a check. If properly regulated, it admits just enough air to supplement that admitted through the draft damper, and is a great aid in inducing perfect combustion of the coal. The smoke-pipe damper is not always fitted, but with a chimney having a strong draft, it is of great assistance, as it provides better control of the draft than the check damper can alone, especially in windy weather or at night. It should always be fitted between the furnace and

The Feed-Door Damper, Which Supplies Air above the Fire, to Aid in Combustion

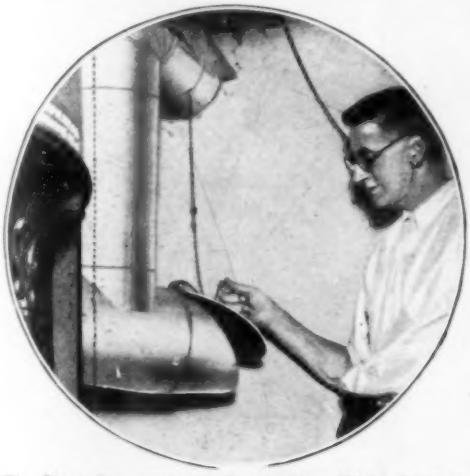
There Are Two Draft Dampers in This Ashpit Door, for Better Regulation

the Home Furnace

Study of Its Little Ways of Heating House

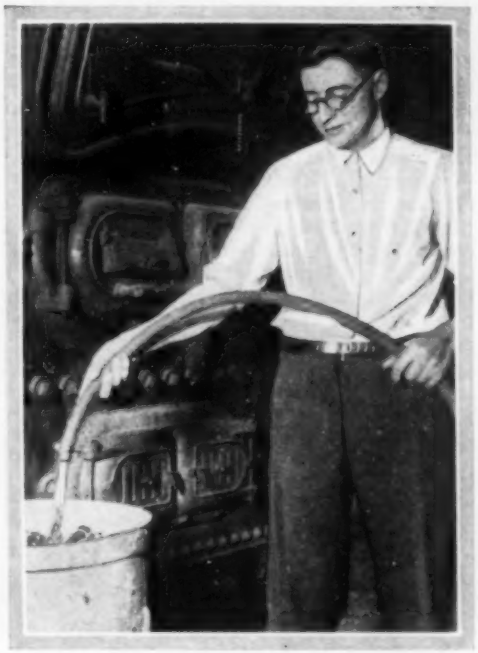
the check damper, never between the check damper and the chimney flue, as it is sometimes found. Soft-coal furnaces are fitted with another damper, known as the hot-blast damper, connecting with an air chamber for admitting hot air above the fire.

When starting the fire, place some light material in the firepot and a little heavier wood on top; then open the draft damper wide, close the check and feed-door dampers and set the smoke-pipe damper so that the wood burns well, but not too fast. When it is burning briskly, throw on some



The Check Damper in the Smoke Pipe, Which Reduces the Draft in the Chimney

coal, spreading it well over the burning wood. Do not throw on too much at one time, and see that the fire continues to burn well. If blue flames spring up all over the surface of the coal when the feed door is opened, open the feed-door damper to admit enough air to burn off the gases arising from the top of the coal. When the blue flames disappear, close the feed-door damper and allow the fire to burn until the desired temperature of the house has been reached. The draft damper should then be closed and the check damper opened until the fire seems to "stand still"; it may be found necessary to let the draft damper stand open slightly, in fact, it will usually be found

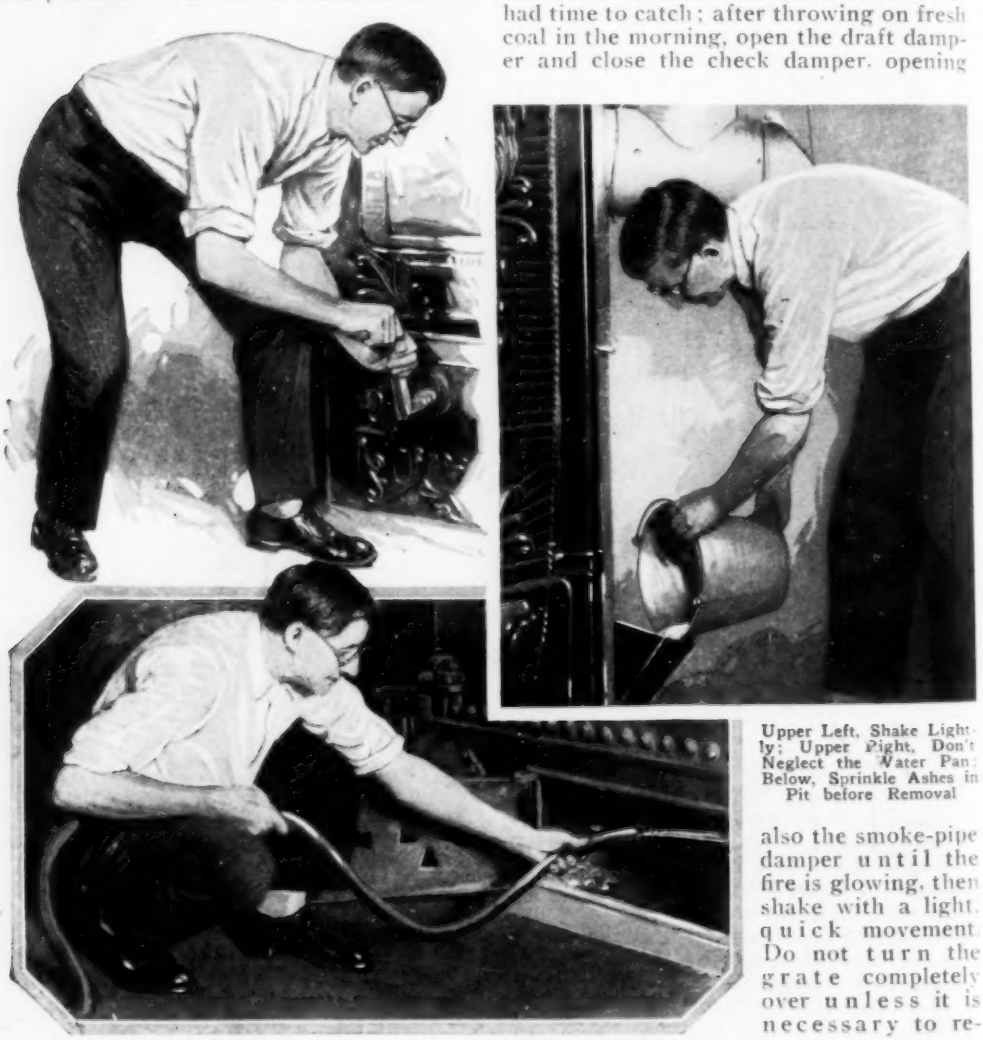


Sprinkle the Ashes before Removal from the Basement, but Not too Much

necessary to experiment with the check and draft dampers until the position is found for each that will hold the fire at the desired point. It is usual to have the check damper connected by means of a chain to a regulator on the floor above, so that the fire can be checked or increased without the necessity of going down to the furnace, and, while this is a convenience, an occasional trip should be made downstairs so that the condition of the fire can be observed and proper attention paid to it.

Keep the Ashpit Free from Ashes and Clinkers to Permit the Air to Get to the Fire

When banking the fire for the night, close the check damper and open the draft damper, and allow them to remain in this position until the blue flames over the banking coal or cinders disappear, indicating that the coal is not giving off any more unconsumed gases, then open the check and feed-door dampers and close the draft damper. It may be found advisable to close the smoke-pipe damper entirely, but this is also a matter for experiment, as it depends on the installation, the chimney and the weather. Different grades of coal affect the damper regulation also, as some coals require more air for complete combustion than others. The only way to learn to regulate the dampers is by trial and error, but the process is well worth while, as it will result in increased economy of operation. A fire should not be shaken down more than three times a day, and twice will usually be found sufficient, in the morning and at night. Care should be taken not to shake it too much, and live coals should not be shaken through the grate. In mild weather an accumulation of ashes can be allowed to lie on the grate. The ashpit is so designed that enough air can pass through it to enable the coal to be burned completely, but this effect cannot be obtained if the ashes are allowed to accumulate in the ashpit until they choke it. Clean out the ashes immediately after shaking, and avoid not only the hindrance to combustion, but also the danger of burned and warped grate bars. Also, the fire should not be shaken until it has had time to catch; after throwing on fresh coal in the morning, open the draft damper and close the check damper, opening



Upper Left, Shake Lightly; Upper Right, Don't Neglect the Water Pan; Below, Sprinkle Ashes in Pit before Removal

also the smoke-pipe damper until the fire is glowing, then shake with a light, quick movement. Do not turn the grate completely over unless it is necessary to re-

move a large clinker. When the first bright cinder is seen to fall through the grate, stop shaking and remove the ashes, sprinkling them a little—not too much—before removing them. A small watering pot kept near the furnace is good for sprinkling the ashes, but the spray nozzle on the hose will answer.

The fire should not be poked unless it is necessary to break up a mass of caking coal to prevent it from fusing over the grate. With large pieces of this character, it is best to pry them to the top of the fire, where they can be broken up and removed through the fire door, rather than to overturn the fire in the attempt to dislodge them through the grate. There must be a good fire on top of the mass before this is attempted, however, or else the fire may have to be coaxed with wood. If there is a good bed of live coals in the fire before the mass is pried to the top, the addition of fresh coal is all that is necessary.

Before removing the ashes to the alley, it is well to sprinkle them a little again to keep down the dust as much as possible.

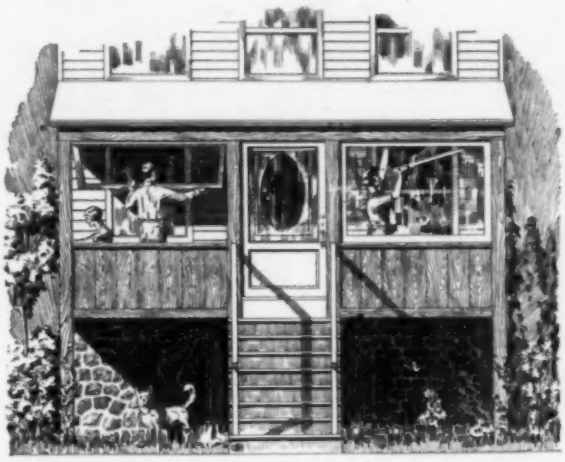
A factor in the cost of heating a house that is little considered is the humidity of the heated air. Most furnaces are fitted with a water pan, but this is usually set so low down in the body of the furnace that it is not of much account. The home mechanic can improve it by moving it up in the furnace so that it is well within the warm-air space, and with its bottom at least 2 in. above the top of the combustion chamber. A supply pipe with a ball stopcock and an overflow tube makes it easy to keep the pan filled with water.

In an article published in the April, 1925, issue of this magazine the proper method of feeding the coal to the fire was explained, and the reader is referred to this article for full information on the subject.

¶ Retouching fluid can be applied to the negative one drop at a time by using a small oilcan and keeping the opening closed by means of a glass-headed pin.

Hanging Window Sash on Porches

It is a great asset to have the porches inclosed during the winter months. In many cases sash are provided and take the place of the screens which are used in summer. Changing them means considerable work, however, and while stored away, the glass may be broken. To overcome these objections, I had sash made that were hinged at the top, so that they could be raised inward and fastened securely to the porch ceiling with hooks. The screens were fastened on the outside of the porch so that they did not interfere with the sash if it was desired to let them down. When real cold weather starts, the screens are, of course, removed.—Mrs. E. O. Swope, Danville, Pa.



Convenient Method of Hinging Porch Sash Which Permits Hanging Them Up against the Ceiling

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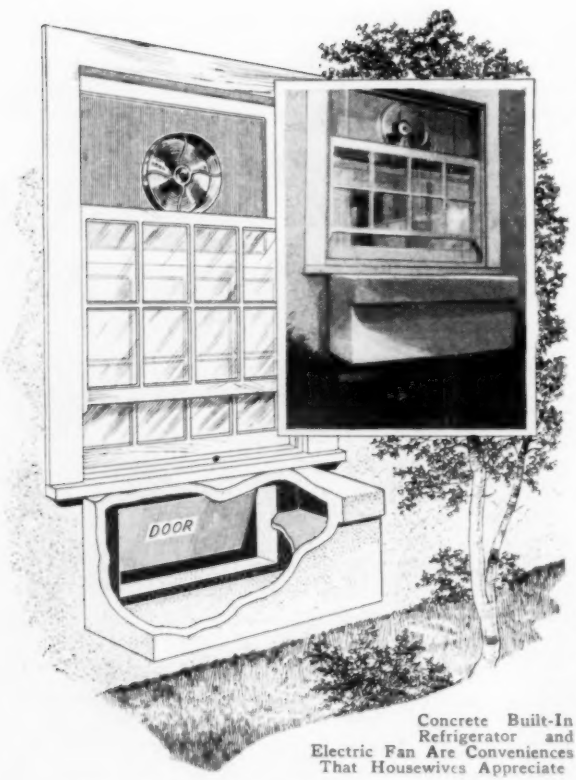
Saving the Dip Net

Where dip nets are used in streams with rocky or gravel beds, the part that surrounds the wire frame soon becomes worn and frayed. One expert fisherman protected his net by splitting an old inner tube and stitching one half of it over the wire frame, as shown in the drawing. When the rubber begins to show wear, it can easily be replaced.—Dale R. Van Horn, Walton, Nebraska.

Strip from Inner Tube Saves Net from Wear



Concrete Built-In Refrigerator and Electric Fan Are Conveniences That Housewives Appreciate

Concrete Window Refrigerator

Made of concrete, the refrigerator shown in the drawing is a considerable improvement upon the wooden window box, which is quite common. It is built as part of the wall of the house and opens into the kitchen. There is a drop door, the inside of which is heavily padded with heat-resistant material to prevent the heat from the kitchen from getting through to the food. Inside of the box there is the usual shelving. Built as thick as it is, this window box not only serves to keep things cool without freezing during the winter but also helps keep out the heat in summer. If desired, ice can be used.—Felix J. Koch, Cincinnati, Ohio.

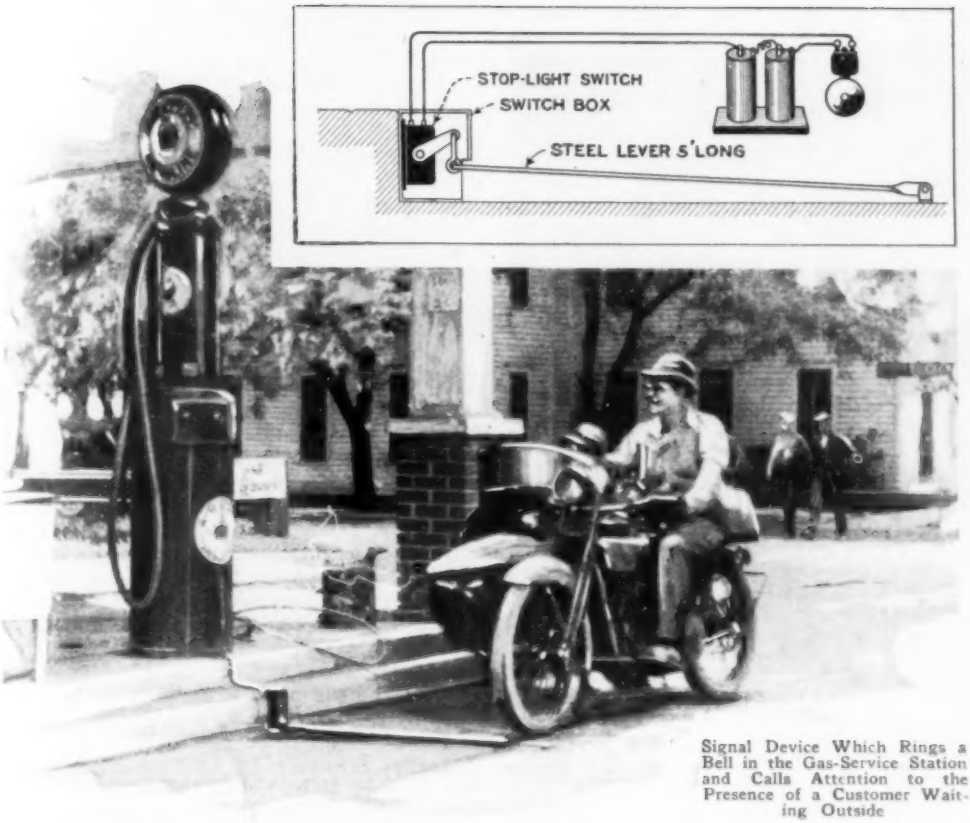
How to Make a Humidity Indicator

A simple weather indicator that may be used in determining the condition of the atmosphere is made as follows: Dress a small figure, in the form of a doll, with a piece of cloth, previously dipped in the following solution: Chloride of cobalt, 30 parts by weight; sodium chloride, 15 parts; gum arabic, 7½ parts; calcium chloride, 4½ parts and water, 400 parts. This cloth will change color as the amount of moisture in the atmosphere changes, the change being due to the cobalt salt, which, in dry air is lavender blue. As the moisture in the atmosphere increases, the color changes first to bluish red, then light red and finally pink, according to the amount of moisture. With a decrease in moisture, the colors change in the reverse order, and the blue color returns when the air becomes dry.

Sheet-Iron Foot Scraper

If one wishes to depart from the conventional style of foot scraper, here is an idea that may be of value. The scraper can be cut out of sheet iron with a cold chisel, the pattern resembling an animal or bird. In the drawing, one scraper is made in the shape of a dog, the other resembling an owl or parrot. In making them, be sure to use heavy sheet iron, especially if the pattern calls for some of the metal to be cut away at the base. The outline can be drawn on the metal with chalk and then cut out with the chisel. It does not matter if the outline is ragged or a bit irregular, as it can be filed smooth later. As the scrapers are set in concrete blocks, part of the sheet metal underneath the design is allowed to remain so that it can be anchored in the concrete.

Ornamental Foot Scrapers Resembling Animals and Birds Improve the Appearance of the Doorstep



Signal Device Which Rings a Bell in the Gas-Service Station and Calls Attention to the Presence of a Customer Waiting Outside

Bell Signal for Service Station

As a signal to call his attention to the presence of a customer, the owner of a gas-service station installed the bell-ringing device shown in the photo. The insert shows the arrangement and wiring diagram. A steel lever about 5 ft. long is laid in the auto track so that the car must ride over it. When this takes place, a switch is closed for an instant and causes a bell to ring, which may be located at any convenient place in the station.—C. O. Cole, Wichita, Kans.

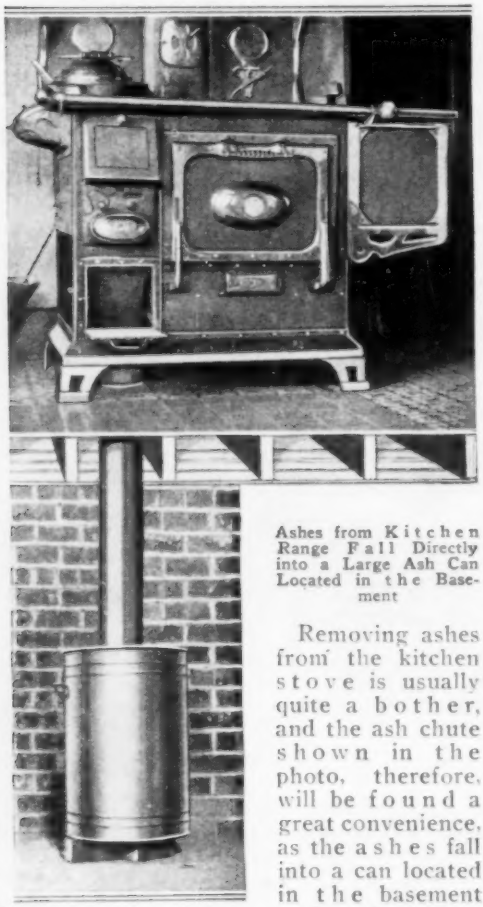
Treating New Paintbrushes

Failure of good paintbrushes to render service usually is due to improper treatment before dipping them into the paint. They should be thoroughly cleaned before they are used. Work them against the hand or a board until all dust and loose hairs are worked out. Then place the brush in clean water and let it remain there until the hairs are well saturated. Finally, shake out all the water and allow the brush to dry. When so treated, new brushes will last longer and will work better.—L. H. Georger, Buffalo, N. Y.

Wash-Basin Base for Lamp Prevents Fire

Dangerous fires have been caused by ordinary lanterns accidentally knocked over. To eliminate this hazard, one farmer mounted his lanterns on ordinary tin wash pans. These provide such a wide base that there is practically no danger of the lantern upsetting. The edges of the lantern base are soldered to the bottom of the wash pan. When soldering, the oil should, of course, be removed.—L. M. Jordan, Vredenburgh, Ala.

Removing Ashes from Kitchen Stove



Ashes from Kitchen Range Fall Directly into a Large Ash Can Located in the Basement

Removing ashes from the kitchen stove is usually quite a bother, and the ash chute shown in the photo, therefore, will be found a great convenience, as the ashes fall into a can located in the basement under the stove. The ordinary ash pan is removed, and a stovepipe brought up from the basement, as indicated. A galvanized-iron hopper with sloping sides and a short circular pipe at the bottom takes its place. The short pipe fits in the top of the stovepipe leading to the ash can.

Making Glass Transparencies

A great number of the amateur photographers have made glass transparencies by contact printing, using regular photo plates instead of paper. Few have gone farther than this, either framing or just binding the transparency so that it can be hung up in some location where the light shows through it. A better way is to make the transparency in the usual way and use a clear glass for a backing, placing a sheet of thin, colored tissue paper between the two glasses and then binding the glasses with gummed tape. In this way different effects can be obtained by using the same view with colored tissue papers, or by placing bright-colored tin foil between the two glasses. When using the tinfoil plan, there will be no transparency from side to side of the photo but from the front only and the picture can be placed in any location where there is light on its surface. The bright foil underneath will bring out the picture clearly.

Saw Vise from Old Bed Rails

An old bed rail, picked up in the junk yard, can be made into a serviceable saw vise by the home mechanic. The horizontal bars, which form the jaws of the vise, are cut 14 in. long, and notched in the center to admit the vertical members. The two sets of bars are drilled and tapped, the holes being countersunk on the inside of the jaws. Draw up the screws tightly, saw off the parts projecting outside of the jaws, and rivet over to prevent loosening. The vertical bars should not exceed 16 in. in length. The fulcrum bar, bolted to both vertical bars, should keep them ½ in. apart. Drill a $^{15}/_{32}$-in. hole in the lower end of the outer vertical bar and tap for a ½ by 2-in. capscrew. This, when forced against the opposite bar, brings the jaws together firmly. The fulcrum bar should not be over 10 in. below the jaws. Attach the vise to the workbench with one or preferably two short pieces fixed to the inner vertical bar, as shown.

Useful Saw Vise for the Home Mechanic Made from Old Bed Rails

CONNECTING ELECTRIC ACCESSORIES on the AUTOMOBILE

Connecting Accessories to the Ford Manifold Terminal Block

"WHERE'S J. J.?" asked Bill Smith, alighting from his car at the door of John Jackson's garage. "In the shop," replied Hank, J. J.'s gas and oil attendant and general handy man, as he unlocked the gasoline pump. "Anything I can do for you? You must be in a hurry this morning, you're around so early." "No," replied Bill. "I just want J. J. to wire up my spotlight. You know I've got to go over to Centerville tonight, and J. J. didn't have a spotlight in the house last night, so I bought one over at the hardware store, and they didn't know how to wire it." "You've been driving a car for five years, Bill. Why didn't you wire it up yourself?" broke in a voice behind them, as J. J. strolled out of the garage. "it's an easy job." "Maybe it is, John, but I don't know how to do it," replied Bill. "Well, gimme the works, and I'll show you how it's done, and then when you buy a cigar lighter or some other gadget in another town, where they haven't a good-natured garageman to wire it for you, you can do the job yourself.

"Connecting a spotlight, hand warmer or any other kind of electrical device on the car is extremely simple," said J. J., as he started to work. "Most accessories of this kind have switches of their own, the spotlight usually having a switch in the handle, while a cigar lighter makes its circuit when it is pulled from the socket. Practically all cars nowadays have the single-wire or grounded wiring system, and this also makes the wiring of accessories a simple matter. The first thing to do, of course, is to decide on the position of the accessory, and mount it. Convenience is the thing to be consulted usually in this, and in the case of a cigar lighter, the best position is the one on the dash nearest the driver. It might seem a little discourteous not to mount the lighter nearest the position of the other fellow in the seat, but he has nothing else to do but reach over and grab it, while the driver has to attend to business, and can't afford to let much else interfere with that.

"Some drivers prefer their spotlight on their own side, where they can adjust it while driving, and others mount it on the right side of the windshield, and adjust it to the side of the road, then let it alone. On the right side, it annoys approaching drivers somewhat less than when on the left, but, on the other hand, it cannot then be used to read signposts or house numbers. For my own part, I prefer it mounted down below the headlights, on the front of the car, and directed on the right-hand edge of the road. In this position it gives the maximum light where it is most wanted, and it cannot glare into an approaching driver's eyes. For reading signs, and that sort of thing, I have another spot mounted on the windshield frame. However, it's all a matter of choice.

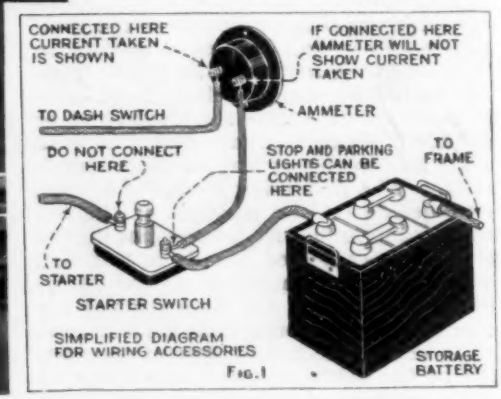
"Having mounted the device, one of the wires is connected to the frame. The proper way to do this is to remove the nut and washer from a convenient bolt on the frame—and the bolt too, if possible—clean off the rust and paint from the frame member around the bolt and brighten it with a file or emery cloth, polish the un-

derside of the washer with the emery cloth also, skin the wire and brighten it, loop it around the bolt—so—then place the washer back with the bright side against the wire, replace the nut and tighten it. (See Fig. 2.) This makes a good clean connection, and one that won't give you any trouble for a long time. A light coat of shellac over the joint is an additional precaution against corrosion, but care should be taken not to put on such a coat that the shellac will creep between the wire and the frame or washer and ruin the connection. Now the other wire can be connected, and it will usually be found convenient to connect it to one side of the ammeter. There are two terminals on the ammeter, and if the wire is connected to one terminal, the current consumed by the accessory will register on the instrument; if connected to the other, it won't. Whether it registers or not is largely a matter of choice; I prefer it to register, in the case of a spotlight. If it is a heater that is being attached, like a hand warmer or a carburetor heater, it is better that the current doesn't pass through the ammeter, as it usually is somewhat heavy, and might injure it. Switch on your spotlight. Now we'll try the end of the wire on this terminal. Doesn't show any reading? All right, we'll try it on the other. It shows now, doesn't it? There, she's tight. That's all there is to it. If it doesn't register when connected to one terminal, try the other. What if you don't know which is the 'on' position of the accessory switch? Oh, that's easy, just wire temporarily direct to the battery terminals and try the switch both ways; that'll soon show which is the right position.

"I remember that the first car I had to put a spotlight on had no ammeter. I was kind o' green at this electrical game at the time, and it stuck me. My boss showed me how to do it, though, and it's just as simple as this job. He first found the 'on' position of the switch, in the way I just mentioned, and turned it on. Then he turned the lighting and ignition switch on the instrument board off, and connected one wire from the spotlight to the frame, just like this. Then he started touching the bared end of the other wire to the terminals on the back of the lighting switch until he found one where the spot would light up, and that was the one he connected it to. If you ever run into a car like that, however, be sure that the accessory switch is turned on, or you'll be likely to hunt a long time for the right terminal.

"A stoplight or parking light may sometimes more conveniently be connected to one side of the starting switch (Fig. 1), but be sure to connect it on the battery side of the switch, where the battery wire is connected to the ammeter. In this case, of course, the current taken by the light is not registered on the ammeter.

"There is another way to connect a spotlight that has some advantages. The spot is usually trained on the right-hand side of the road, and in many cases is not used when the bright lights are on, the driver turn-



Here Is a Simplified Diagram of the Wiring Involved in Connecting Accessories on the Car

ing on the spotlight when he switches from bright to dim on meeting another car. This means two motions. If the spotlight wire is connected to the terminal on the back of the lighting switch that supplies current for the dim lights or for the small side lights, the act of switching from bright to dim will turn on the spot at the same time. On the Ford, this connection may be made at the connection block or manifold at the front of the dash. On the older type, the connection block has five terminals, and the spotlight is connected to the second one from the left—the one carrying the yellow wire—if the light is to be connected to the battery at all times. (See Fig. 3, A.) If you want it on with the dim lights only, connect it to the terminal on the extreme right (B, Fig. 3); this terminal carries a yellow wire—if you can make out the color. On the newer Fords the block has six terminals, and the third from the left, carrying the yellow wires, gives a direct battery connection. The one on the right as before, (but now carrying black wires) connects the light to the dim circuit.

"Suppose you forget which terminal is which? That's easy! In this case, the lighting switch is turned to the 'dim' position, and the end of the wire touched to the terminals on the block, in turn, until one is found that will light the spot. To make sure that it is the right one, switch to 'bright' and see if the spotlight goes out. If it does, it's OK; if not, you'll have to try again, as you may have hit the horn terminal, or some other one.

"Connecting stoplights? Well, there are a number of ways to do this job, but the simplest way for the average owner is to connect one wire, from the stoplight switch, to one side of the starting switch and the other wire to one of the terminals on the stoplight socket. The other socket terminal is grounded to the frame. If you want to have an indicator that will show whether the stoplight is working or not, and I would advise having this, for a stoplight that isn't working is worse than none at all, then you can install another dash-light socket carrying a 2-cp. bulb, on the instrument board. Run one wire from the ammeter terminal to one on the dash socket, and another wire from the socket to the stoplight switch, then to the light, which is grounded to the frame as usual. This is the simplest way, although by no means the best. You can color the dash bulb red so that it will show up strongly whenever the light is operated.

"When you get a stoplight, examine the switch thoroughly and see that it is well made, for the switch is usually the weakest part of the installation, and most of the stoplights that are not working have inoperative switches. Look at the switch occasionally after it is installed and see that it stays in good condition—an ounce of prevention is worth a pound of cure, you know, and this applies to all the electrical accessories. I will tell you more some other time about the other ways to install stoplights.

"Most accessories are connected by

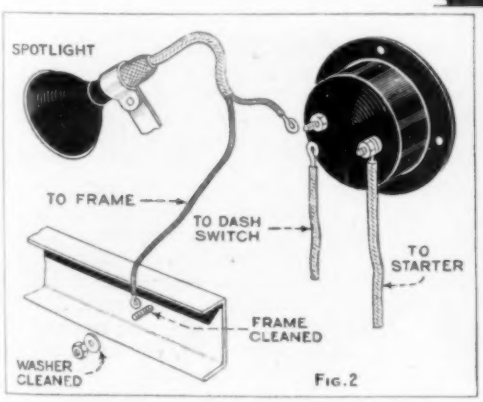
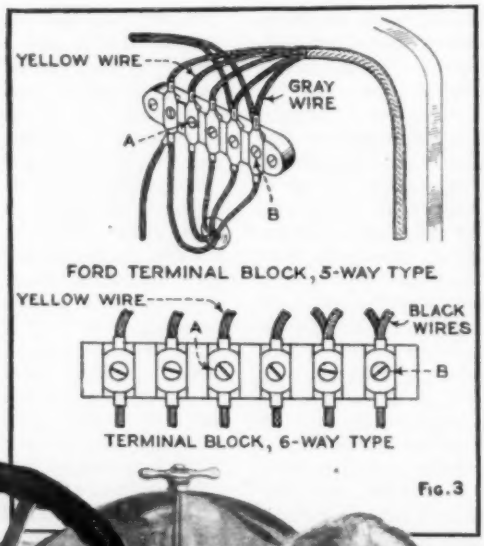


FIG. 2

The Ends of All Wires Should Be Bared and Scraped Clean, and All Frame Contacts Polished

means of flexible cords, and these will kink and fray, leading eventually to breaks and short circuits. See that the wires are stapled to the body or fastened to the frame firmly. Wires leading inside the car can be sewed to the upholstery, and this is usually the neatest way to fasten them. Under the car, they can be stapled to the floorboards. If armored wire is used, slip a short length of rubber tubing over it wherever it touches the frame of the sheet-metal body, so as to prevent rattles that may prove difficult to find some time in the future.

"There you are, Bill, all set. No, no trouble at all, only next time let me sell you the accessory as well as install it for you. Sure! I hadn't any spotlight yesterday but I'll have them in this afternoon. So long!"



Testing on the Ammeter Terminals before Tightening; Above, Connections for the Ford System

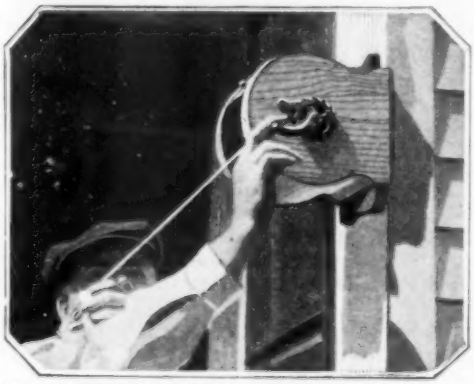
How to Remedy a Common Clock Trouble

The minute hand of a clock sometimes catches against or under the hour hand, which gradually brings the clock to a standstill. If the hands are released, the clock will run till the hands catch again, but it will strike wrong because the minute hand has dragged the hour hand out of position. An hour hand has a round hole in it and fits on a round section of the spindle; it may be turned forward or backward without injury to the works. But a minute hand has a square hole in it and fits on a square section of the spindle; this hand, therefore, may be moved forward harmlessly, but it is risky to try to force it backward. There is a simple way to remedy this trouble. First turn the minute hand straight up, pointing to twelve. Stop the clock. Pull out the pin that is in the spindle in front of the hands. Remove the minute hand. If it is crooked, bending toward the hour hand, it should be straightened, but before attempting to straighten or to bend a clock hand be sure to heat it. Some clock hands are hard and brittle and will break if one tries to change their shape when cold. It is seldom necessary to alter the hour hand, for hour hands are usually perfectly straight, but if bent, it is best to straighten this hand also, using the same precautions

against breakage. Push the butt of the hour hand in until it is flush with the shoulder on the spindle. Then replace the minute hand, point upward. Next, insert a pin in the hole in the spindle in front of the hands. Such a key should project at least ⅛ in., at both ends, outside of the spindle. If the pin that has been in use is not long enough, whittle a new one out of a piece of hardwood. Lastly, pack the space between the pin and the minute hand by wrapping the spindle with a string. Continue wrapping until the roll of cord reaches nearly to the ends of the pin. Then tie a hard knot and clip off the ends of the string. Such packing, carefully done, holds the minute hand firmly against the shoulder of the spindle and tilts the point of it outward, away from the hour hand. The erratic striking must then be corrected. To do this, start the pendulum and wait till the clock strikes two or more. Count the strokes. While holding the minute hand at twelve, and stopping the clock, turn the hour hand to the hour that was struck. If the repaired clock is found to be behind correct time, move the minute hand forward slowly, always pausing for the clock to strike, till the hands point right. If the repaired clock is ahead of correct time, do not start it till the governing timepiece catches up. Then put the pendulum to swinging. If there's nothing wrong with the works, regular winding thereafter will keep the clock going and it will strike right.—Dr. H. D. Ribble, Blacksburg, Va.

Homemade Clothes-Line Reel

This clothes-line reel is attached to one corner of the house and is always ready for use. The sides are made of wood, cut to the shape shown in the photo; the top and bottom are pieces of sheet metal, and a sliding sheet-metal door is provided in front to protect the line against the elements when not in use. The reel is operated by a crank in connection with a pawl and ratchet to keep the line taut.



Novel Homemade Clothes-Line Reel Is Attached to Corner of the House

Binding Pamphlets

Having some pamphlets which I wanted to keep for reference and therefore desired to bind in some inexpensive way, I devised the method shown in the photo, and found it entirely satisfactory.

Cheap and Satisfactory Method of Binding Pamphlets and Magazines

Two holes were punched through the pamphlets and through two pieces of red "leatherboard," which were used as covers, so that all of the holes registered. For each binder two pieces of 1/16-in. piano wire, 1 in. shorter than the pamphlets, and two steel coil springs of ⅛-in. diameter, about 1 in. long and looped at both ends, were obtained. The springs were slipped through the holes in the assembled covers and pamphlets and the wire rods threaded through the spring loops at top and bottom. When the thickness of the pile exceeded the length of the springs, a hook was used to pull them up, after which the rod was again slipped through the top loop. In this way the pamphlets were held together tightly and could be handled like a book.—Leslie H. Phinney, Springfield, Mass.

Opening Tin Cans

If the point of the opener is inserted just below the beading of the can top, with its heel at the left of the vertical seam,

Cutting Tin Cans through the Side Is Easy and Permits All the Food to Be Removed

it can be run around the can with much less effort than is required in cutting through the top. Besides, by using this method, the extra force needed to make the flat blade follow a curved path is eliminated. Opened in this way, the can is emptied readily and completely, while a top-opened can usually leaves a jagged edge that retains some of the food and is much more likely to cause injuries than the comparatively clean edge produced by side cutting.—Chester Lynndelle, Trenton, N. J.

Removing Play in Ford Fan

The new style Ford fans often develop end play due to excessive wear. As the front end of such fans is closed, the fan would have to be taken off and the blades removed from the pulley before the shaft could be turned in to remedy the play in the usual way. A better method of taking up this play is to remove the cotter pin from the locknut at the rear end of the fan shaft and loosen the lock about one full turn. Then place a cotter pin through the nut and the fan shaft, but do not spread the ends. Next, turn the locknut with a wrench and the fan shaft will turn with it. Turn the shaft in until only a very slight end play can be felt. Then remove the cotter pin through the locknut and tighten it. Replace the cotter pin through the locknut and spread the ends. The locknut on such fans must be kept tight and the cotter pin in place, or the fan will eventually turn the shaft in so tightly that the fan will stop.—E. T. Gunderson, Humboldt, Iowa.

Nickelplating Brass

Some time ago I had some brass boat parts which I desired to nickelplate. A friend of mine told me how it could be done without using an electric current. The following is his method: Dissolve 8 oz. of sal ammoniac and 8 oz. of double nickel salts in 1 gal. of water, then heat the solution nearly to the boiling point. Now put in your brass or copper articles together with some scrap aluminum, taking care that the aluminum touches the articles to be nickeled. In a short time a nickel deposit will be found on the brass. Although this deposit is not as heavy as that obtained by electroplating, it may be lightly buffed and will be satisfactory in many cases.—Ralph Hanenkratt, Albany, N. Y.

Counterweight on Cellar Door Aids in Operating

Cellar doors of the type shown in the photo are more or less difficult to handle and there is always danger of their falling down, which may cause a serious accident when one is ascending or descending the steps. A counterweight eliminates this risk entirely. Simply attach a pulley to the side of the house and run a length of sash cord over it, fastening one end of the cord to the cellar door and the other to a suitable counterweight. A 2-in. pipe filled with concrete will serve nicely for this purpose.

Writing Cabinet for the Library Table

By GEO. H. CAPPEL

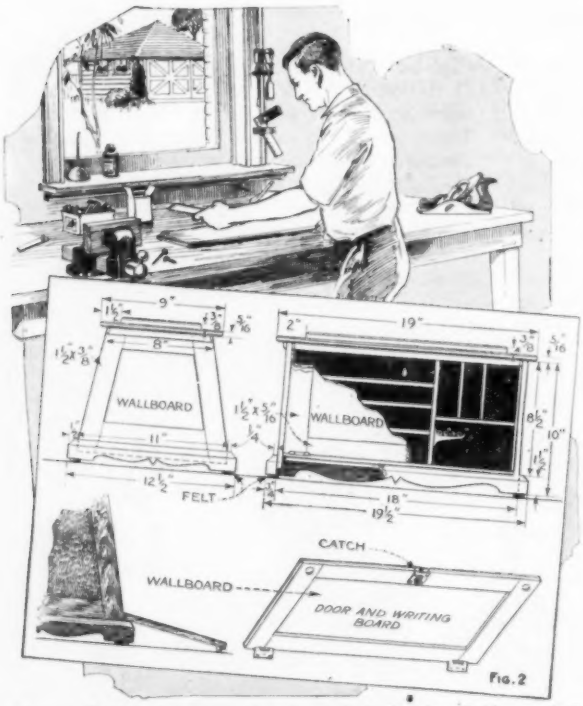
AN attractive and roomy writing cabinet, which is set on the library table and will easily hold all writing materials, paste, etc., can be made by anyone handy with tools and careful to follow instructions. Ordinary wallboard may be used for the back, front or writing door, and for the end panels, while cypress is used for the top, base and edges.

The cabinet is 19½ in. long, 12½ in. wide at the base and 9 in. at the top, and is 10¾ in. high. This is about the most convenient size for the ordinary library table. The sides, back and front are made first. The wood is glued to the wallboard and then tacked on the inside so that no nails will be exposed. The base is then put on. The curved lines are first penciled off carefully and then cut out with a scrollsaw. The bottom, which also may be of wallboard, is next put in place; it is held by wooden cleats, nailed inside of the sides, back and front. The top is a nicely grained piece of cypress, nailed to the back and end with headless nails, which are sunk with a nail set and the holes filled with putty or wood filler. The door is then fitted in place; it is hinged to the base with two or three small nickel hinges and a catch, which can be obtained at any hardware store. If desired, a lock may be used. The inside is partitioned off to suit the user. Thin stock is used for this purpose. Pieces of felt or rubber-head tacks are used on the bottom of the cabinet and on the door, where it rests on the table when open.

All the woodwork is stained with asphalt thinned with gasoline, rubbed off with a cloth, followed up with two applications of shellac, applying the second coat after the first has dried thoroughly. It is finished with wax, which will give a neat appearance. The panels or exposed parts of the wallboard are papered with wall paper, to match that of the room. This will make quite a novel and unusual type of writing cabinet.

Paneled Writing Cabinet Is Designed to Stand on the Library Table and Has Plenty of Space for All the Writing Materials

The method of staining previously mentioned gives a golden-oak finish, of a depth depending on how much the asphaltum is thinned. For a fumed or mission-oak finish, use wood dye or a similar penetrating stain, smoothing the rough surface, after staining, with fine sandpaper and finishing with wax as before. Varying shades of oak, walnut and mahogany can be obtained in the wood dyes, so that the cabinet can be finished to suit the furniture in the room.



Anyone Handy with Tools Can Build This Writing Cabinet. It Is Made of Cypress and Wallboard

Where prepared dyes and stains cannot easily be obtained, the amateur can make his own. Mahogany stain may be made by dissolving Bismarck brown in alcohol. Mission-oak finish may be obtained by exposing the wood for a day or two to the fumes of strong ammonia (28 per cent) in a tightly closed box. If the wood is moistened with water just before exposure, the resulting stain will be darker than if fumed dry. The surface must be sandpapered after fuming and before waxing or oiling.

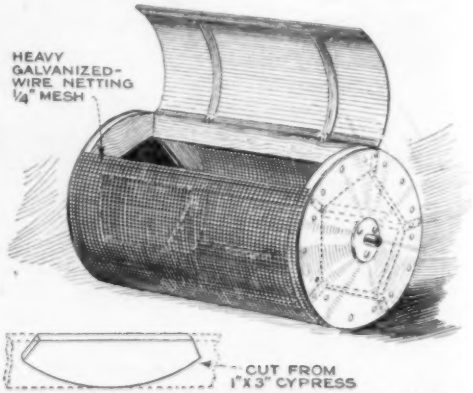
If a varnished finish is desired, the surface should be filled, using a good paste filler, applied, after staining, in the manner specified by the maker. The filler must be well rubbed off, when dry, with fine shavings or cotton waste, rubbing across the grain. After sandpapering, the wood is ready for the varnish.

Improving Roofing Paint

Tar or asphalt roofing paint makes a lasting and very cheap covering for a tin roof even though it is badly pitted with rust. A great objection to many of these preparations, however, is the fact that they are black and absorb so much heat as to make the house perceptibly warmer. In recent tests of black and white paints as applied to oil tanks, it was found that the latter rose in temperature only 19 to 22° and lost only 9 per cent of their naphtha content as compared to a temperature increase of 54° in tanks covered with black paint. Obviously similar conditions hold true where the roof of a house is coated white or black. A cheap and effective method of overcoming the objection to the use of asphalt paint is to dust its surface with beach sand or finely powdered stone of some light color. The paint will soften when the sun shines on it so that the stone or sand will stick.

Rebuilding Washing-Machine Cylinder

The revolving cylinder in our electric washing machine began to wear out. The perforated metal covering around the cylinder was breaking from hole to hole, which let the clothes work through and tear. However, the two ends, the wooden crosspieces and the lid were still in good condition, as was the rest of the machine. A new cylinder would cost $28, so I decided to rebuild the old one myself. After carefully removing the worn-out coverings from the ends where they were rimmed together, I sawed ten pieces of 1 by 3-in. cypress to the shape shown in the detail. These pieces were placed from one crosspiece to another entirely around the ends as shown by the dotted lines, and were fastened to the metal ends with cop-



Galvanized Wire Mesh Used to Repair a Washing-Machine Cylinder

per screws. This braced the crosspieces and also served as a base to fasten the edges of ¼-in. galvanized-iron mesh. I used the 24-in. width and as the cylinder was 22 in. long, this permitted overlapping the mesh about an inch to fit inside of the edge of the cylinder. Starting at the crosspieces where the lid is hinged, I fastened the mesh by using 3/16-in. round-head bolts, 3¾ in. long, placing the heads inside of the cylinder so that they would be drawn slightly into the wood when tightened up and would leave no sharp edges to tear the clothes. I lapped the ends of the mesh about an inch to get a better hold. A strip of sheet brass was placed between the wood and the mesh. The bolts were then tightened after placing a washer under the nut. The sheet brass was turned over the nuts, after cutting off the ends of the bolts, and screwed down to cover the rough edge of the mesh. The mesh was then drawn around the cylinder, putting in a few temporary screws to hold it in place. It was fastened to the other side of the lid opening on the crosspiece in the same way as before. Putting this netting on was a rather tedious task but it has proved entirely satisfactory.—S. E. Schofield, Indianapolis, Ind.

Burnt Match Receiver

During fire-prevention week, the children in our schools were required to contrive some novelty that would aid the purpose. Our eight-year-old lad noticed how a dangerous fire had once started in our kitchen by dropping a still blazing match into a receptacle near the stove. So he decided to prevent a recurrence. Taking an empty tin can, he pierced the bottom with a large nail, pressed the oval lid in place at the top and then placed the can in an inverted position near the stove. The burnt matches are dropped into the container through the holes, and when full, the can is emptied. The matches seldom continue to burn after they are dropped into the can and if they do, the flame soon goes out.—Rev. Lewis F. Freyberg, Zanesville, Ohio.

Driving Small Wood Lathe by Foot

The treadle attachment on a wood lathe shown in the illustration has been used successfully for two years. The attachment consists of an old Ford engine block with the crankshaft, two connecting rods and a Chevrolet flywheel. The flywheel was turned down and holes drilled in it so that it would fit on the end of the crankshaft, and the face crowned to keep the belt on. An idler pulley is fastened to the bench top to permit adjustment of the belt. Two connecting rods are used to support the idler pulley and these are fastened to a block of 1-in. wood, which has slots cut in it and is held to the bench top with screws and wingnuts. The pedals are hinged to a crosspiece under the bench and are connected to the crankshaft.—J. P. Kincaid, Durant, Okla.

Running a Small Wood Lathe with a Treadle Attachment

Starting Furnace Fire with Gas

For starting a furnace fire quickly, one man bent a 2-ft. length of ¼-in. gas pipe to a 45° angle and attached to it a length of rubber hose, which he connected to the nearest gas fixture. When the furnace fire is desired no kindling is used, but this improvised gas burner is held under the grate and in a few minutes the coals will glow. This method is perfectly safe and eliminates chopping of kindling, which is more or less difficult to get in large cities.—Mrs. V. S. Martin, Detroit, Michigan.

Lighting the Fish Bowl

An illuminated fish bowl, which is attractive in the den or parlor, can easily be constructed in the home workshop. The

Electrically Illuminated Fish Bowl Adds to the Appearance of the Parlor

stand shown is 12 in. square by 4 in. high, but the size will, of course, have to be varied according to the size of the bowl, which in this case is a cylindrical jar. If a wood-turning lathe is available, the stand may be turned round, although a square stand is the easiest to make. A square of cardboard with a circle cut out equal to the diameter of the bottom of the bowl is inserted under the ground glass, to prevent the light from escaping around the sides of the bowl. Illumination is provided by a 6-volt lamp which can be run on a bell circuit obtained by the use of a bell-ringing transformer. The stand may be stained or varnished to harmonize with the furniture, and be made as elaborate as desired. Two small holes should be drilled in the rear to permit heated air to escape.—R. B. Clifton, Denver, Colo.

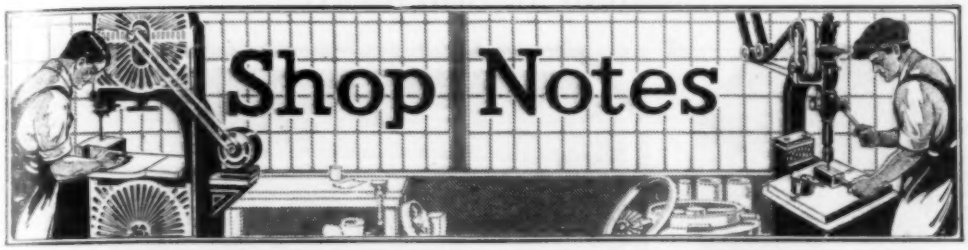
Avoiding Battery Trouble

Regular use of a good hydrometer is the only way to know whether or not a storage battery is getting a proper charge. The heaviness of the acid is the only true indicator of the condition of the battery and the hydrometer measures this. Never leave a battery in a discharged condition and, whether in use or not, don't leave it without attention for a long period of time. When not in use, a fully charged battery will become one-third discharged in a month or so. Neither should a battery be overcharged. The gassing produced if this is done disintegrates the active material in the plates. Keep the battery well charged in winter. This may necessitate increasing the charging rate over the summer normal. A fully charged battery cannot freeze. Keep the hold-down bolts tight, or the box will be damaged and the terminals are likely to be loosened, due to shaking of the battery which allows acid to creep up around them. Also, sediment will settle between the plates and cause an internal short circuit. Never add anything but distilled water to the electrolyte; boiled water won't do. And never fill the battery with "trick" solutions.—A. C. Cole, Chicago, Ill.

Sidewalks of Colored Squares

Quite a novel departure in the construction of cement sidewalks is shown in the photo. The pavement is made up of large colored squares. The colors are mixed in the cement in separate batches, which should be worked up carefully. Wooden frames of 2 by 4-in. lumber are used as forms, and tar paper is placed between adjacent squares to keep the colors from running together. It is not necessary to use colored cement for the entire thickness of each block; the base can be made of ordinary concrete and a ¾-in. thickness of cement applied on top. Ground colors for cement work can be purchased at any paint store.—M. A. Ayers, San Francisco, Calif.

Large Squares of Different-Colored Cement Make an Unusually Attractive Sidewalk

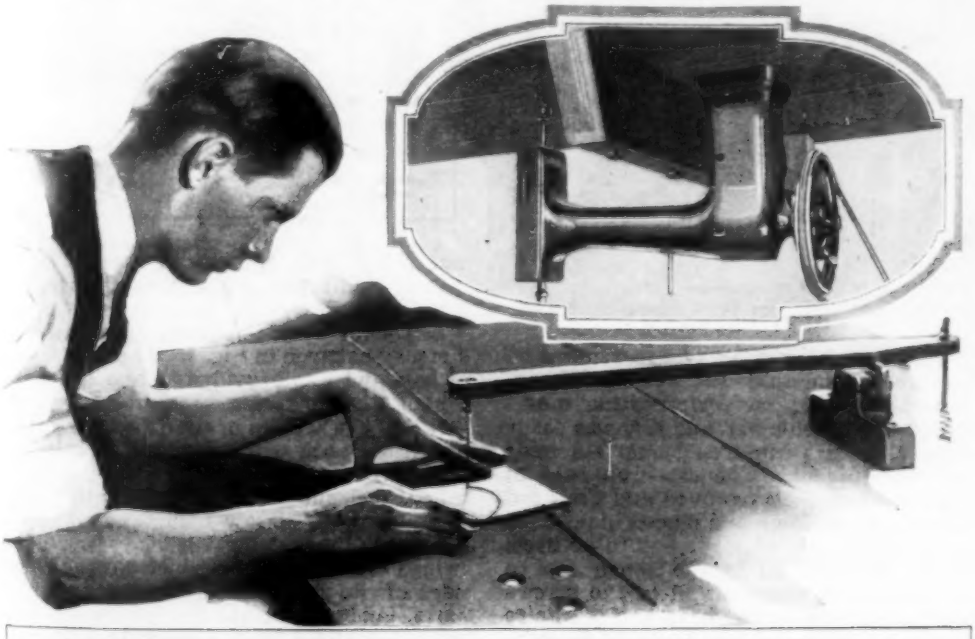


All Shop Notes published in 1925, in book form—Fifty Cents—from our Book Department

A Jigsaw for a Dollar

By M. ORDAHL

WANTING a jigsaw for his shop, but not having the wherewithal at the moment to buy one, a mechanic set out to improvise one. After thinking the matter of a suitable mechanism over for some time, he decided that the easiest thing from which to make it was an old sewing machine. Half an hour's search of the secondhand stores in the neighborhood resulted in his parting with a dollar and acquiring an old head, the insides of which were all present and in good order.



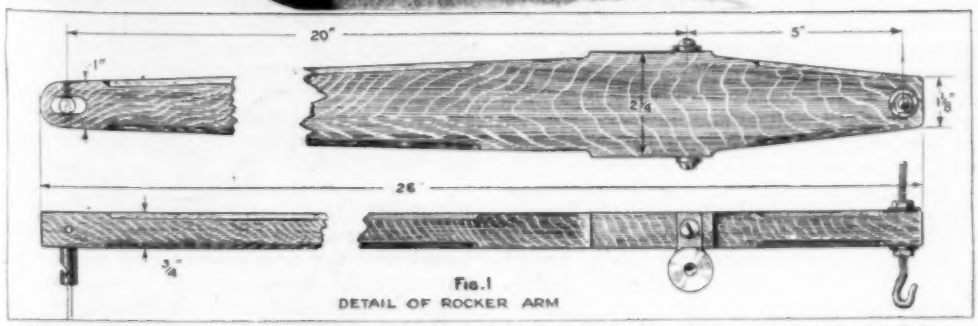
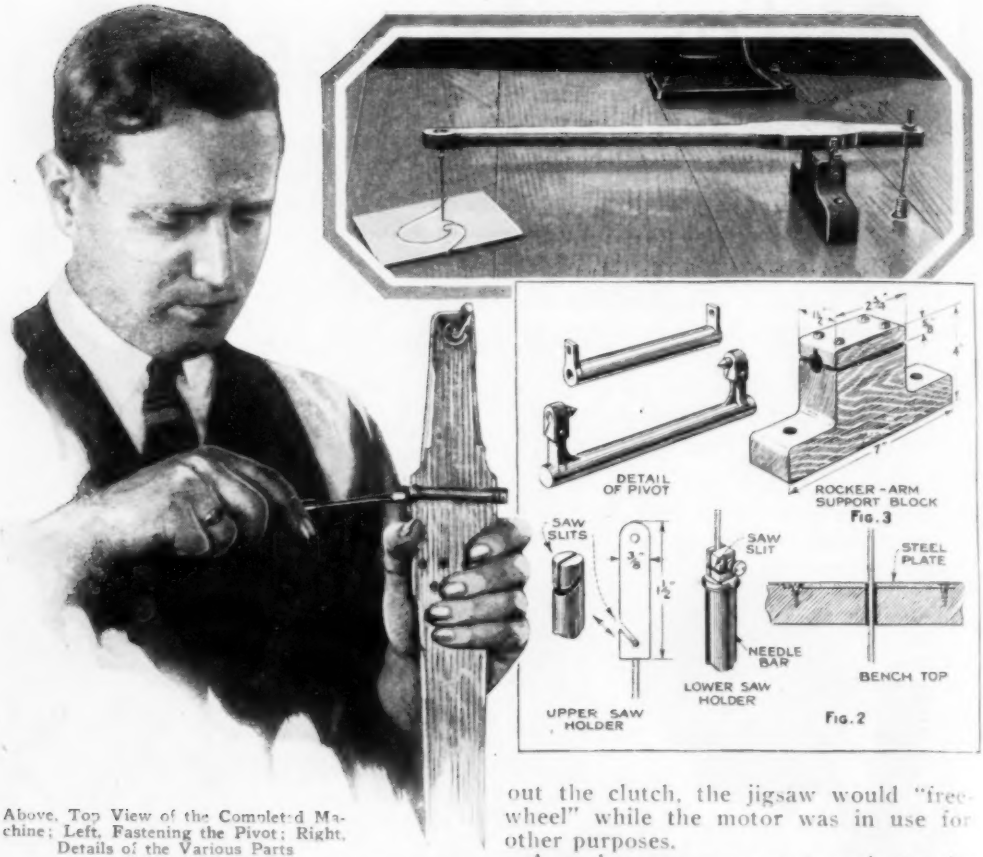


FIG. 1
DETAIL OF ROCKER ARM

A Jigsaw Made from an Old Sewing-Machine Head; Insert, the Head in Position under the Bench; Below, the Rocker Arm



Above, Top View of the Completed Machine; Left, Fastening the Pivot; Right, Details of the Various Parts

The first thing done was to remove all the mechanism that was not directly involved in giving the reciprocating movement to the needle bar, and this was easily done, the parts removed being laid aside for the moment. The cast-iron base of the head was then removed and the head turned upside down and placed in position under the bench where it was to be used. Holes were drilled in the bench top to correspond to the position of the screws that formerly held the base, the old holes in the head tapped out to fit ¼-in. capscrews, and the head fastened in place. The heads of the capscrews were counterbored into the bench top so as not to interfere with the work, and a small hole was drilled in the top of the bench in line with the end of the needle bar.

As the saw was to be driven from a small motor mounted on the base of the bench, the flywheel was removed from the sewing machine and grooved for a ¼-in. round belt. There was plenty of stock for this. Incidentally, the wheel had a small clutch that was used when winding bobbins, and this worked in very nicely, as, by throwing out the clutch, the jigsaw would "freewheel" while the motor was in use for other purposes.

A rocker arm was next made to the dimensions given in Fig. 1. This was made of oak, and was provided at one end with a hook for the spring, made from a ¼-in. bolt. The other end of the arm was slotted and fitted with a saw holder. This was made from a short piece of ⅜-in. cold-rolled steel, slit with the hacksaw to admit the end of the jigsaw blade and to catch the blade pins (see Fig. 2). The saw holder swings on a brass pin, driven through the sides of the arm. Upon looking over the parts taken from the underside of the sewing-machine head, a pivot and pivoted shaft were found, which, with a few minutes' work, were adapted to form a pivot for the rocker arm. One of the parts had two lugs that were cut off to length, drilled for small wood screws and fastened to the rocker arm. The other part had two adjusting-screw centers and was fitted into a support block, made as shown in Fig. 3. This, in turn, was bolted to the top of the bench and the arm slipped into place and adjusted by means of the pivot screws. Directly below the hook on the rear end of the arm, a hole was bored in the bench, and a spring (taken from an old bed

spring) hooked on, passed through the hole and held in place by means of a short piece of ¼-in. rod through the end.

It was only found necessary to cut a cross slit in the end of the needle bar in the head to adapt it to holding the saws. The top of the bench was recessed to take a sheet-steel plate, through which the saw passed, and the saw was complete.

The motor driving the saw has a speed of 1,750 r. p. m. The grooved wheel on the saw is approximately 5½ in. in diameter, and a 3-in. pulley on the motor will run the saw at a satisfactory speed.

Washing Auto Windows

For washing automobile windows that have become covered with oil, dirt or dust, the following formula will be found excellent: 1 gal. water, ½ cup alcohol, ½ cup ammonia, and 1 tablespoon salt. The water, of course, serves its usual function as a cleanser, the alcohol aids in drying and saves a lot of rubbing, and the ammonia and salt cut the grease and fix the luster on the glass. This is splendid for general window washing also, and to give a high luster to fine cut glass.

Improving the Crowbar

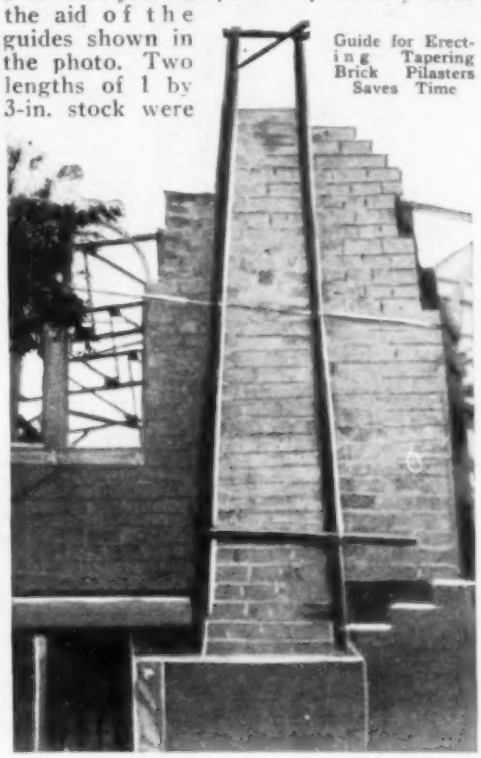
Crowbars of the usual type can be greatly improved by providing a handle at one end, as shown in the photo. This prevents blistering of the hands and the bar can be manipulated more conveniently. To make this handle, one end of the bar is split with a hacksaw and the halves rounded to form the sides and handle. A short piece of pipe is slipped over the ends just before they are bent together.

Non-Blistering Handle on Crowbar Increases Ease of Manipulation

A 5½-ft. bar has been found most convenient for farm work, and for chopping through ice, frozen ground, etc.

Building Tapering Brick Pilasters

Building tapering brick pilasters seemed a difficult job, but proved quite easy with the aid of the guides shown in the photo. Two lengths of 1 by 3-in. stock were cut to the required height. These were braced by smaller crosspieces, and wires were used to hold the sides together. The pilasters were then built up inside. This method proved timesaving and enabled the builder to make all the pilasters alike. —E. J. Veronda, South Pasadena, Calif.



Guide for Erecting Tapering Brick Pilasters Saves Time

Relief for "Burning" Feet

Workmen in machine shops and garages will find relief from "burning" or "scalding" feet, if they cut an inner sole for their shoes from ordinary cork gasket or packing material. After cutting the cork to fit, it is securely fastened in the shoes by shellacking the bottom side of the cork and applying a light coat along the middle of the sole. If the size of the shoe permits, make these inner soles of two thicknesses of cork.

¶When making ring gauges, always leave a thin collar on each end of the hole, so that any bell-mouthing in lapping can be ground off.

Paint-Pot Hanger

Nearly all paint-pot hangers are arranged for use on a ladder, or to attach to some place on the wall which is suited

Simple Paint-Pot Hanger for Shingled Walls

for the purpose. The one shown in the illustration is designed for use when painting a shingled house. It consists of a piece of hardwood, 6 or 8 in. long, with a hook in one end, from which the pot is suspended, and a long strap hinge screwed to the other, as shown. The upper end of the hinge is left in normal condition, but the lower end should be filed down to a sharp point and bent away from the stick at right angles. The method of using this hanger is evident from the illustration. The weight of the paint pot will force the pointed end of the hinge into the wood.—L. B. Robbins, Harwich, Massachusetts.

Emergency Water Supply for Washroom

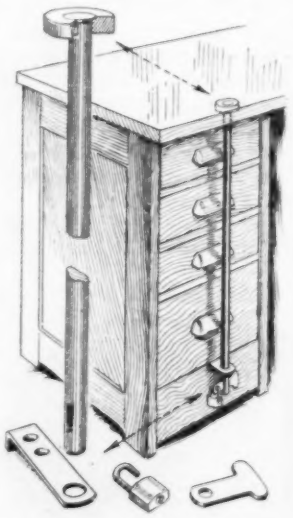
A break in the water pipe supplying the men's washroom made some repair necessary as it was near quitting time and scores of men would demand water for cleaning up. As the break could not be fixed at once, the pipe was uncoupled and plugged on the washroom side of the break with a hardwood plug and a garden hose attached to one of the faucets in the washroom and run to a sprinkling hydrant outside. Then, by opening this particular faucet and turning on the hydrant, water was forced backward into the faucet under high pressure and a fair pressure was obtained at each faucet in the washroom.—Harold E. Benson, Boulder, Colorado.

Removing Rust from Tools

Many of the so-called rust removers actually remove the rust from objects but also the finished surface of the metal itself. A derusting process has just been evolved in which acids and alkalies are eliminated, a simple chemical substance being used in a water solution. The substance is ammonium citrate. A tablespoonful of this to ½ pt. of water works very well. The chemical is inexpensive, non-corrosive and gives off no fumes; in fact, it is a very agreeable substance to work with. The tools, instruments, etc., are immersed in the solution overnight. In the morning, the rust will be found to have disappeared, the solution being brown, due to the formation of ferric citrate. But the solution can be used until depleted. The articles are then rinsed in water and oiled. If desired, they can be left overnight in a solution of potassium chromate, then rinsed and dried.

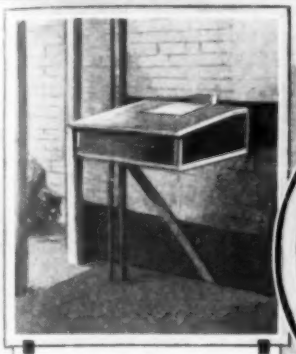
Locking Cabinet Drawers

Cabinet drawers without locks can be made safe by using the method shown in the illustration. The locking device consists of a ⅜-in. iron rod, long enough to pass in front of the drawers, with a collar 1 in. in diameter pressed onto the top end. A 9/16-in. hole is bored through the top of the cabinet and counterbored about ¼ in. deep so that the collar will be flush with the top when the rod is passed through. The lower end of the rod is slotted to take a sheet-metal latch drilled for insertion of a lock, and is held in a perforated strap countersunk into and screwed to the base, as indicated.—R. L. Hill, Saginaw, Mich.

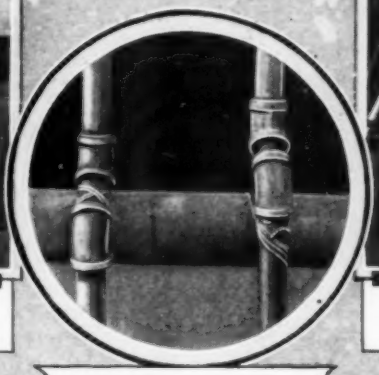


Transparent celluloid, dissolved in acetone, makes a good lacquer for silver.

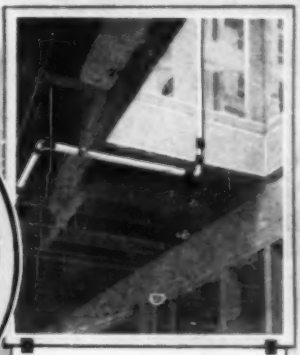
KINKS FOR THE BUILDER



Easily Made Desk for Foreman on Job



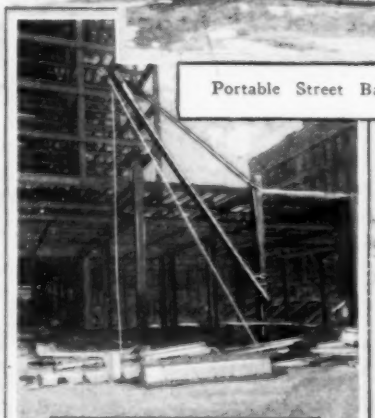
Pipes Wired in This Way Don't Vibrate



Taping Speaking-Tube Joints Prevents Leakage

Portable Street Barricades

Pipe Drains Porch Floor



A Derrick Swung from the Steel Column of a Building under Construction Is Handy for Many Jobs

Simple Wood Vise Attached to Strut for Filing Circular Saws

A Self-Inking Stamp That Can Be Changed Instantly

One day when I had about 50 envelopes that I wished to print with a return address, I found a stencil was in place on my mimeograph. Not wanting to remove it for so short a run, I devised the stamp shown in the illustration. It is self-inking, and the lettering can be changed at any time at a cost of about one cent for each new wording. Although I made the stamp to supplement my mimeograph in marking small articles, such as envelopes, bills, receipts, cards, etc., its use is not limited to owners of mimeographs. It will be found most serviceable to all who have numerous small items to be stamped or printed, but do not care to have a great number of rubber stamps made. Stencil sheets may be purchased for 14 cents and less, depending on size. The 14-cent sheet will make ten to fifteen pieces the size of a stamp pad. The typewriting or drawing is done on the stencil before separating it from the backing sheet. Then the backing sheet is torn off, and the stencil cut to the proper size to fit the pad. Sufficient margin is allowed to fold the sheet over the pad; the sheet is stretched tightly over the latter and the ends glued to the bottom. Pads may be bought in the 5 and 10-cent stores. Impressions are made by pressing the paper on the pad firmly. For some purposes, it is expedient to solder a handle to the back of the pad holder, as shown in the drawing, permitting the device to be used as an ordinary stamp. When very large pads are used, the impression should be made with a small roller.—Lucius Winchester, Norwalk, Conn.

Self-Inking Stamp Made from a Mimeograph-Paper Stencil and an Ordinary Pad

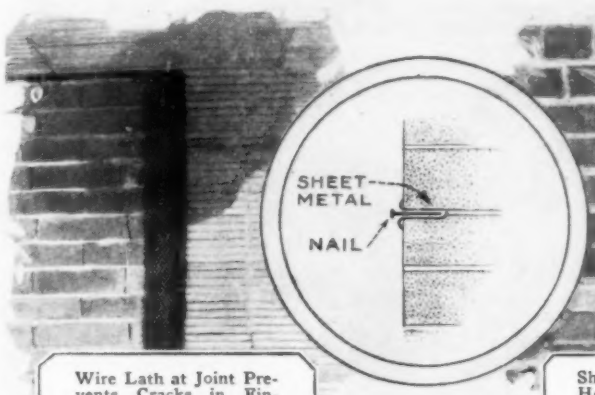
Repairing Broken Triangles

Triangles are easily broken and the draftsman's habits in handling them do not help the situation materially. Fanning ink lines and other practices soon ruin them. Also, in leaning on them, they are sometimes cracked, making it difficult to pick them up when in a flat position. Cracked triangles can be repaired in a very simple and effective manner. Make a solution of 3 parts of alcohol and 4 parts of ether, mixed together well, and apply it to the broken edges, and when more or less warm, press them together, keeping the triangle on a flat surface and using thumbtacks as bracing. Allow the joint to dry for 24 to 36 hours. The triangle will then be as good as new.—L. H. Georger, Buffalo, N. Y.

Telephone Poles Made from Old Water Pipes

The owner of a telephone system found that old, discarded water pipes make good strong telephone poles, which are of special advantage as frequent fires, kindled along the road to clear the brush, will not harm them. The sections of pipe are 25 ft. long and have a piece of round timber driven into the upper end and to this piece the crossarms are bolted. It is necessary to paint these pipes occasionally to prevent deterioration due to rust and if this is done, they will last practically indefinitely.—L. M. Jordan, Vredenburgh, Alabama.

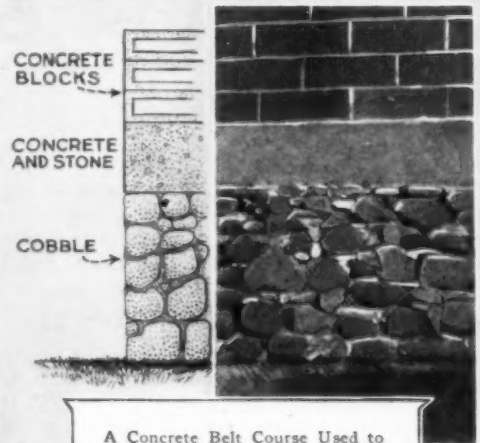
KINKS FOR THE BUILDER



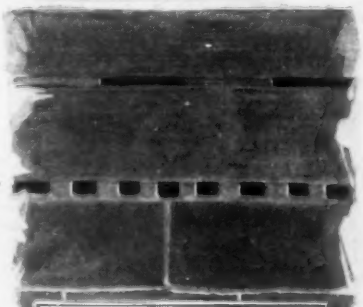
Wire Lath at Joint Prevents Cracks in Finished Plaster

Sheet-Metal Bracket Holds Nails in a Brick Wall

Nails Set in Concrete Floor to Anchor Bumping Post



A Concrete Belt Course Used to Provide a Base for the Cement Blocks

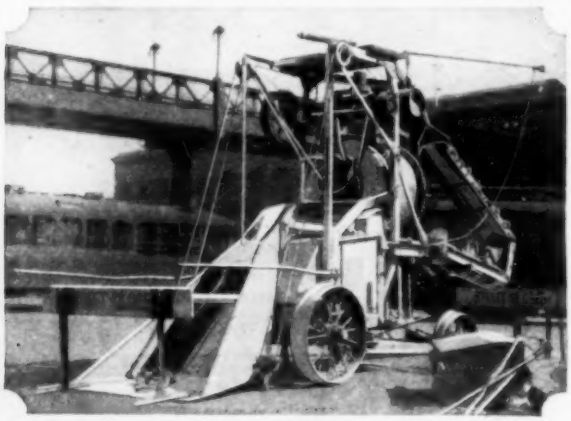


Joist Bedded in Concrete to Make It Firm on Cement Blocks

Beveled Sill of Basement Window Admits More Light and Makes Neat Job; Finished with Cement

Trolley-Operated Concrete Mixer

A novel concrete mixer is being used in San Francisco for paving the street-car tracks. The machine is equipped with flanged wheels, a trolley pole and a motor, which also runs the mixing drum. A swinging spout, about 10 ft. in length, is suspended ahead of the mixer. The outfit is run on one of the tracks while pouring the paving base for the other. As it is used only at night, the mixer is run off the tracks and parked during the day.



Novel Concrete Mixer That Runs on Street-Car Tracks and Uses Trolley Current

Oiling Spring-Perch Nuts

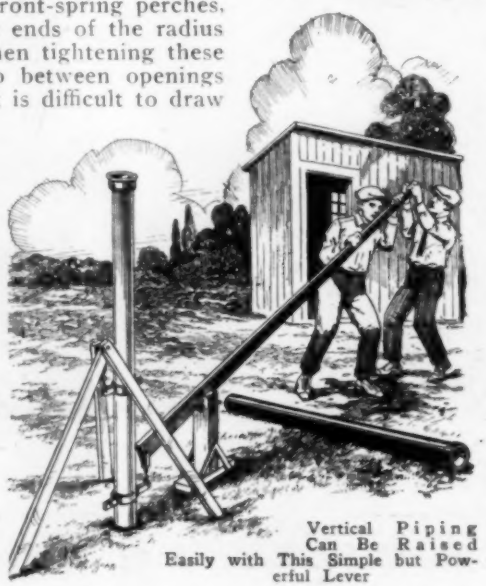
Late-model Ford cars are fitted with conical nuts on the front-spring perches, which keep the front ends of the radius rod to the axle. When tightening these nuts, they often stop between openings for cotter pins and it is difficult to draw them to the next one. As it is hardly practical to grind off the conical end of the nuts to allow them to be turned on farther, they should be backed off several turns and oil applied to the ends. The oil reduces the friction and usually allows the nut to be turned to the next opening for the cotter pin without trouble.—E. T. Gunderson, Humboldt, Iowa.

Marking Trunks

Hunting for a particular trunk among a whole carload of them, or in a baggage room, means a loss of time when one is in a hurry. To avoid this, paint a wide stripe of any bright color all around the trunk on the sides and also across the top and bottom. This makes it visible at all times, no matter in what position the trunk is placed, and it can be picked out of a lot of similar-looking trunks at a glance. The stripe should be painted neatly and be from 3 to 5 in. wide.—H. R. Wallin, Galveston, Tex.

Raising Vertical Piping

For raising heavy vertical pipe, such as pump piping, columns to high water tanks, etc., the device shown in the illustration has been found very effective. It consists of a tripod of 3 by 4-in. wood with a 1-in. bolt through the top from which a short chain is hung. Attached to the end of this chain is a clamp made of two pieces of ½ by 1½-in. strap iron, bent to the shape indicated and held in place by two bolts, to one of which the chain is attached. A lever fulcrumed on a stand, as shown, has a similar chain and clamp attached to its short end. In use, the clamps are fastened around the piping with a sliding fit, so that, when the long lever arm is pressed down, the lower clamp locks the piping and raises it several inches, while the upper clamp grips and holds it when the lever is raised for a new purchase. Pipe may be lowered with the same device by raising the clamps with the hands as the strokes are made and riding the lever upward. The device is also an efficient post puller.—L. M. Jordan, Vredenburgh, Ala.

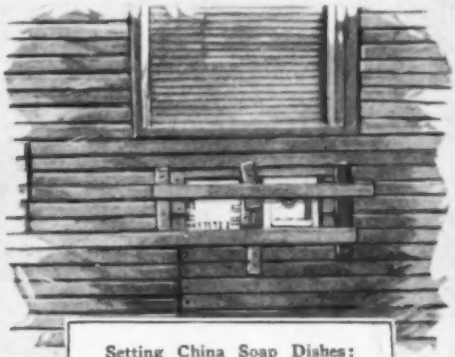


Vertical Piping Can Be Raised Easily with This Simple but Powerful Lever

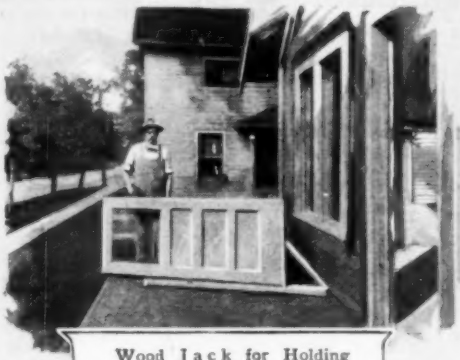
¶Before painting window sash, rub a cloth soaked in kerosene over the glass.

KINKS FOR THE BUILDER

Building Plaster Apron for Bathtub

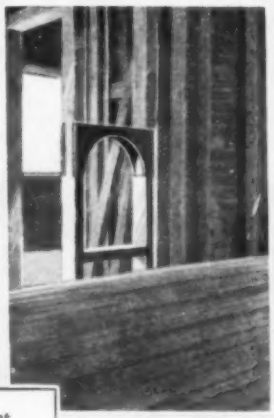


Setting China Soap Dishes; Copper Nails Hold Mortar



Wood Jack for Holding Doors While Planing Edges

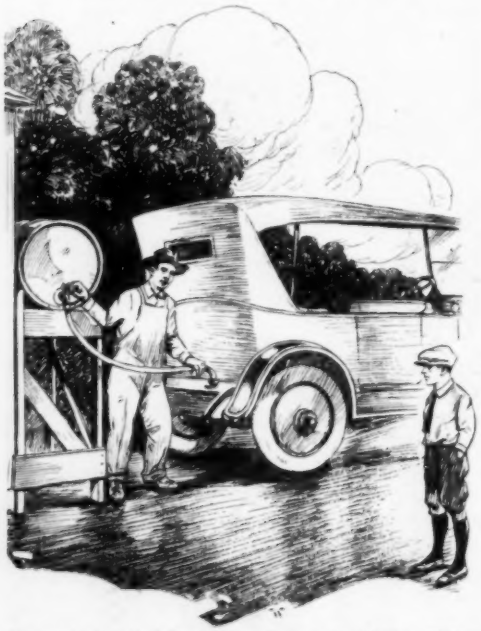
Handy Package Receivers Built in Front-Porch Wall



Left, a Telephone Niche, and Right, the Method of Framing It

Convenient Gasoline Drum

A farmer who believes in having everything convenient, built a substantial platform just outside of his garage for a 50-



Elevated Gasoline Tank near Garage Facilitates Filling of Auto Tank

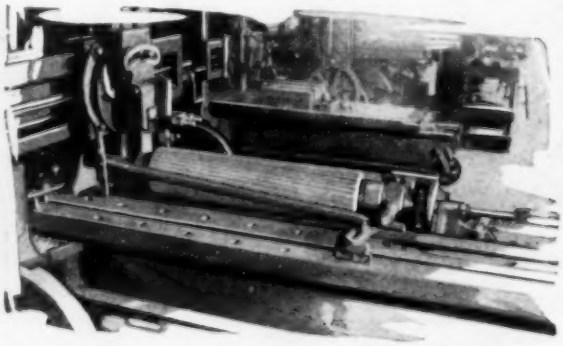
gal. gasoline drum and attached a 5-ft. length of hose to the faucet. The free end is fitted with a small tin cylinder in which is set a strainer of cloth, screen and chamois, to keep out foreign matter.

Operating Small Machinery with Speedometer Parts

When operating small machinery such as laboratory equipment or moving window displays, it is sometimes desired to have the source of power at a distance, to provide a speed reduction or to transmit power at an angle. Where the power under consideration is small, an old speedometer swivel joint and flexible shaft, which can be purchased for a small sum at an auto-wrecking house, will often solve the problem. The gear reduction in these swivel joints is 2½ to 1, and they need no attention as they are grease-packed. The spur-gear wheel is made of fiber and is easily converted into a grooved pulley. The flexible shaft is perfectly satisfactory for transmitting small power, and can be bent in any direction and located where it is impossible to place motors or belts. Another inexpensive ready-made gear reduction is to be found in the small emery grinding wheels which clamp to a bench or table and are crank-operated. They are generally accurately made and can be converted into a speed-changing device with little trouble.

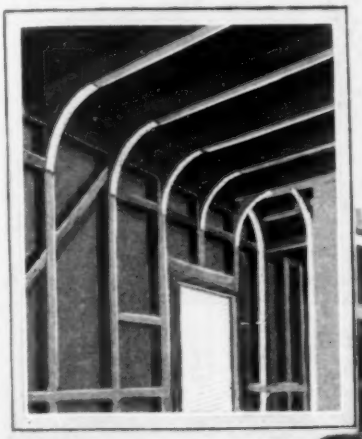
Cutting Spirals

Cutting a spiral or, more correctly, a helix, usually calls for expensive machinery. To do such a job accurately without this equipment is practically impossible, but if the spirals need not be absolutely accurate they can be cut by simpler methods. In the photo is shown a method of cutting a spirally grooved roller in a shop where the only machine that could handle such a large piece was a planer. The roller was mounted on centers and was free to turn about them, subject to the control of a spiraling arm, which was setscrewed into the roller shaft and carried on its end a small roller that traveled up and down on a stationary bar as the whole rig, except the bar, was reciprocated by the motion of the planer bed. A spring set in the far side of the swivel arm kept the roller tight against the bar all the time. After each cut was made, the setscrew was loosened and the roller turned an amount equal to the spacing between the spiral teeth, and then the arm was tightened for another cut. The cutting was done by a tool ground to shape and fed directly downward into the roll. Spirals made in this way answer nicely on such pieces as feed rollers on woodworking machines, leather feed rolls and for grinding. — D. Hampson, Middletown, N. Y.

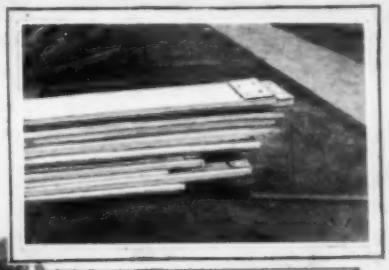


Cutting a Spirally Grooved Roller in a Planer without the Use of Expensive Machinery

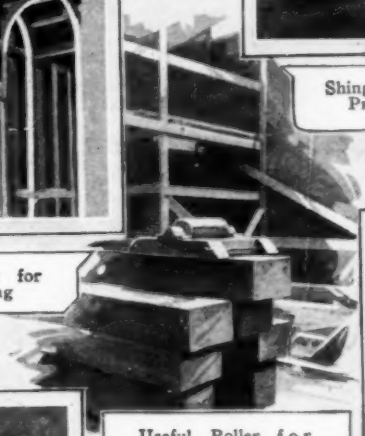
KINKS FOR THE BUILDER



Simple Framing for a Cove Ceiling

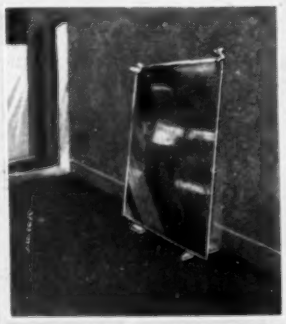


Shingles Nailed to Planks Prevent End-Splitting

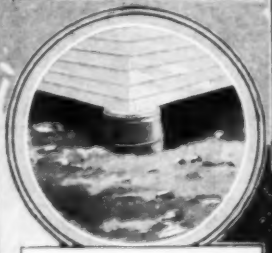


Useful Roller for Handling Long Timbers

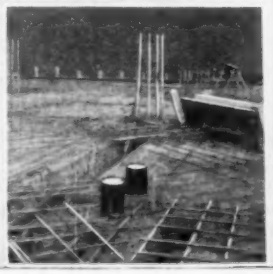
Wood Protector for Projecting Pipe



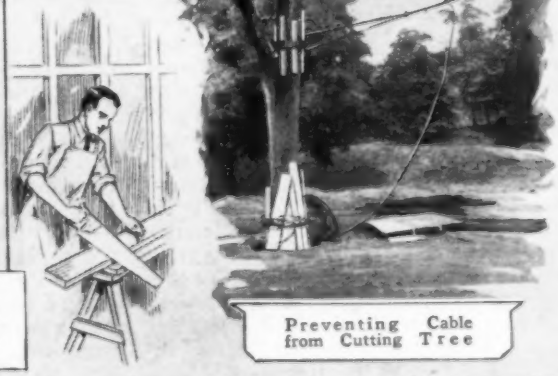
Glass Supported on Blocks Is Less Likely to Crack



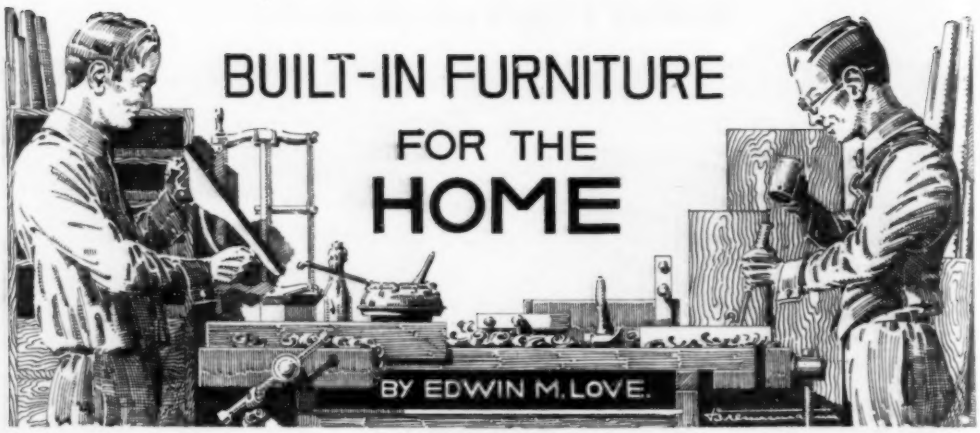
Old Nail Kegs Make Pier Forms



Stovepipes Set in Forms and Filled with Sand Provide Openings in Concrete Floor



Preventing Cable from Cutting Tree



Part XIV—Sewing Cabinet

ASIDE from the novelty of being built into the wall, the sewing cabinet illustrated herewith has numerous worthwhile features to recommend it. The door opens to a horizontal position, and can be used as a cutting table. Six drawers, hinged to open out completely, and a bin nearly 1 ft. square, also hinged, besides shelves, furnish ample storage space, while the partitioned drawer for buttons, the pivoted spool rack, and a work basket built to fit snugly in the remaining space, take care of sewing equipment.

As this piece fits between four studs without any being cut, it is built in three separate sections before being assembled with the casing. All are built of 1 by 5-in. stock, sized to a width of 4½ in. For the six side jambs, cut stock 2 ft. 2 in. long, and rabbet each end on the face side to a depth of ⅜ in. and a width of 1 in., leaving a face side length of 2 ft. Lay out one and use it as a measure for all others. The six top and bottom jambs are exactly 12¾ in. long.

Select a pair of side jambs for the left-hand compartment. Measure up from the bottom shoulders, 4¼ in., locating the upper edges of ⅜-in. dados cut ¼ in. deep. The tops of the next pair are 3½ in. above these. The bottoms of the ¾-in. gains for the heavy shelf are 3½ in. above the top of the one just cut.

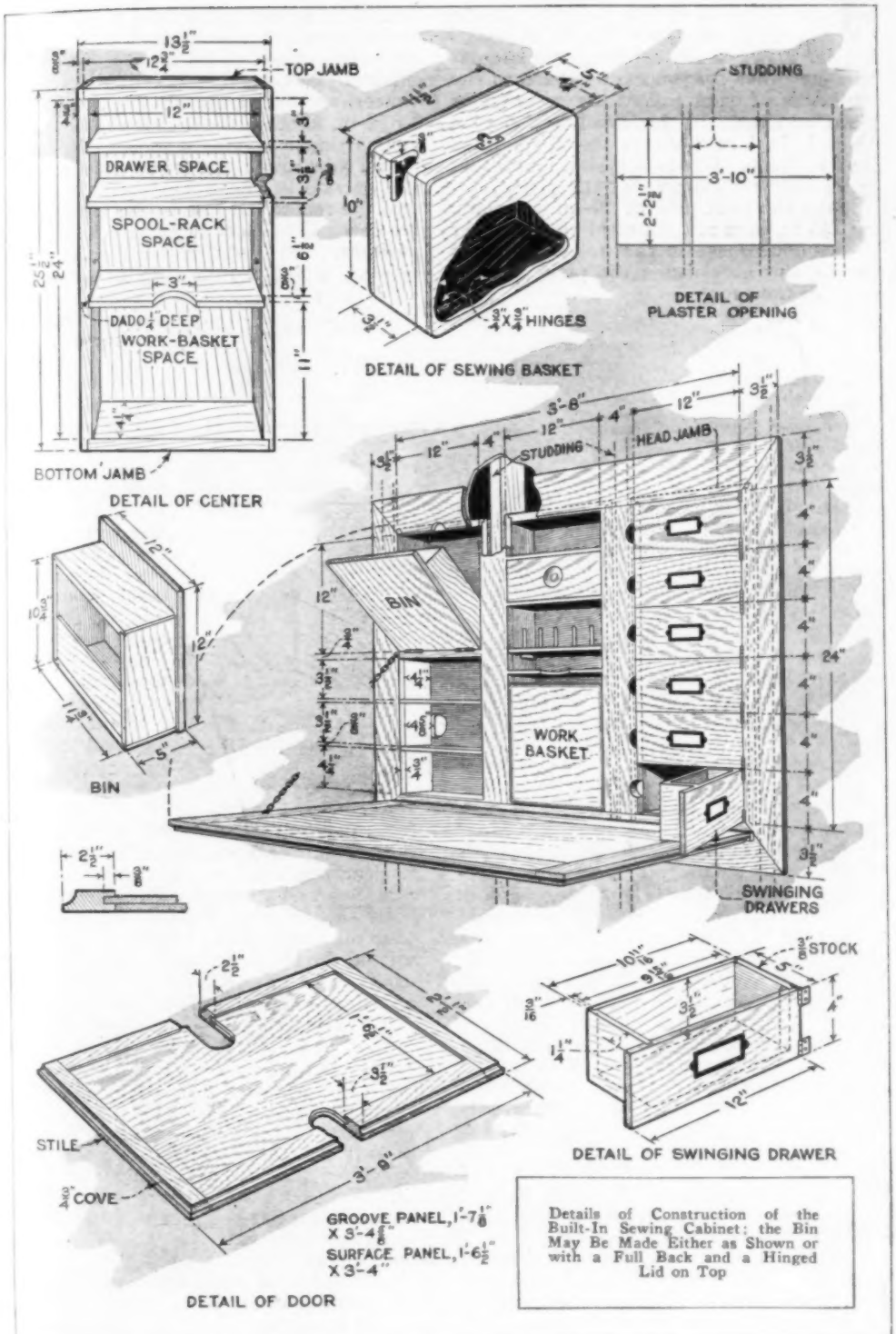
Make the three shelves 5 in. wide and 12½ in. long, and assemble this section of the cabinet. Nail the outer corners both directions with four-penny finish nails. Sight along the side jambs to be sure that they have not been bulged outward by the shelves, and nail through into the thick middle shelf. Now notch the projecting ¾ in. of the shelves by squaring lines flush with the inside faces of the jambs and sawing to the jambs, the waste wood being chipped out with a chisel. Square up the box and tack a diagonal brace across the back.

Build the center section in the same way, this time placing the top of a ⅜-in. shelf 11 in. above the lower jamb, a second shelf 6½ in. above this, and a third, 3½ in. above the second. In the center of each jamb, 1¼ in. above the lower shelf, bore a ⅜-in. hole for a pivot bearing of the spool rack. Cut from the front of the lowest shelf a semicircular segment having a radius of 1½ in., to give finger room for removing the work basket from its recess.

The section at the right consists merely of the jambs, as it is filled with the six pivoted drawers without recourse to rails or shelves.

Assemble the three sections by tacking on the casing muntins of 1 by 5-in. stock, sized to a width of 4 in. and cut to 2 ft. in length. The edges are flush with the inside faces of the jambs. Cut the upper and lower casings of 1 by 4-in. stock, mitering the ends, and nail them solidly to the head jambs of the sections with six-penny finish nails. Fit the side casings and nail them in place. Now lay the cabinet, face down, on the bench or floor, place smooth blocks under the miters of the casings, and drive two ½-in. corrugated fasteners into each. Remove the braces from the back and cover the sections with ⅜-in. three-ply pine or fir panel veneer, cut 1 ft. 1½ in. by 2 ft. 1½ in., one for each section, nailing them on with shingle nails or six-penny finish nails.

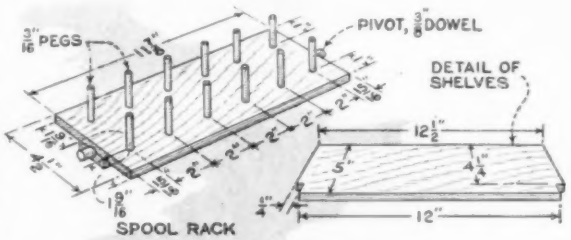
For the spool rack, make a rectangle of ⅜ by 5-in. stock, 4½ by 11⅞ in. in size, and gauge on the face side a pencil line 1 in. from each edge. Centering on these lines, bore six holes $^{3}/_{16}$ in. in diameter, spacing them 2 in. apart; the end ones being $^{15}/_{16}$

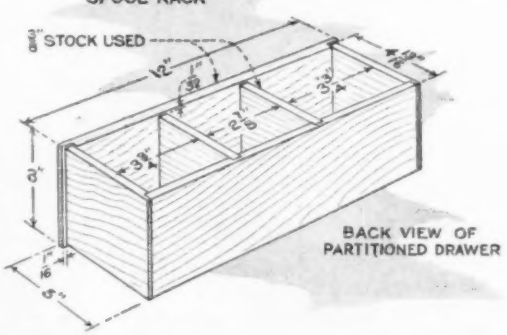


Details of Construction of the Built-In Sewing Cabinet; the Bin May Be Made Either as Shown or with a Full Back and a Hinged Lid on Top

in. from the ends of the material. Make two lugs of ⅜-in. stock, 1⅜ in. wide and 1½ in. long, one end being semicircular and the other square. Glue these to the underside of each end of the rectangular piece, as shown in the detail, and bore a ⅜-in. hole, 1 in. deep, in the ¾-in. stock thus built up. Cut two 1½-in. lengths of ⅜-in. hardwood dowel for the pivots.

Make the rack pins of 3/16-in. doweling, cut 2½ in. long and rounded on the upper ends. Glue these in the holes bored for them. Put glue inside the pivot sockets and slip the rack into place between the holes in the side jambs of the center section. Slip the pivots into place from the backs of the stiles, and allow the glue to set. Glue to the back a small block to act as a stop.





To build the work basket, cut from ⅜ by 10-in. stock two rectangles, 9⅜ by 11½ in., for the top and bottom. The two sides are 3⅛ by 11½ in., rabbeted at each end ⅜ in. wide and 3/16 in. deep for assembling with the ends in the same manner as the cabinet sections. The ends are 3⅛ in. wide by 9⅝ in. long. Size the ends of the endpieces with thin glue, and assemble ends and sides by gluing and nailing with 1-in. brads. In nailing, avoid putting brads where a line drawn 1⅛ in. from the top of the box would pass over one. Nail and glue on top and bottom, carefully smooth the box, and gauge a line 1⅛ in. from the top all around the box. Cut around this line, separating the top from the bottom. Smooth up the edges, and see that the lid fits with a tight joint all around, without any rocking. Round off the outside corners, and hinge the lid to the box with three ¾ by ¾-in. brass hinges. Fit a light clasp in front.

The bin in the upper part of the left section is built in much the same manner. The frame formed by the sides is 10¾ by 11¾ in., the sides being of ⅜-in. stock, 4¼ in. wide. The front is ⅜ in. thick and 12 in. square, glued and nailed on the frame to show a projection of ⅛ in. on three sides and 1¼ in. on the top. Fit a lid and back to this of three-ply panel veneer, and hinge the lid by means of ¾ by ¾-in. hinges inside. Fit the bin to its compartment, leaving a joint of less than 1/16 in. all around the front, which forms the outside of the bin when it is closed into the recess. Hinge to the lower shelf. No catch is needed, as gravity holds it in position. To hold it horizontal when opened, attach a thin strip of leather to the back of the bin and the shelf, so that it will be drawn tight when the bin is opened.

The detail of the partitioned drawer gives the dimensions. Rabbet the ends into the front and the back into the ends, and dado the front ends of the partitions into the front ¼ in. Butt the other ends to the back, and nail the bottom over all. Back, ends and partitions are all of ⅜-in. stock. 2 5/16 in. wide, which gives 1/32-in. clearance top and bottom; 1/16-in. clearance is given in width. Fit the front closely by beveling ends and edges.

The six swinging drawers are all alike. Make the fronts ⅜ by 4 by 12 in., and 1¼ in. from the left ends, inside, cut ⅜-in. dados, ⅛ in. deep. Rabbet the other ends 3/16 in. deep and 7/16 in. wide. The sides that fit into the dados are 4⅜ in. long, rabbeted 3/16 in. deep and ⅜ in. wide, to receive the backs. The other ends are cut 4 7/16 in. long. The inside depth of the drawers is 3½ in., which gives a front projection over the bottom of ⅛ in. It is necessary to set the ends back, as shown, so that they will clear when the drawer is being opened or shut. Reinforce the hinge joint by gluing in a ⅜-in. quarter-round, and fit and hang the lowest drawer. Fit and hang the others consecutively.

Build the door stiles and upper rail of 1⅛ by 3-in. stock, sized to 2½ in. in width, and the lower rail of 4-in. stock, sized to 3½. Make the panel groove ⅜ in. from

the inside, so that, after assembly of the door a second sheet of panel veneer may be fitted over the first to make the inside flush. Work a ¾-in. cove on the outside of the door, as shown. Hang it with three cabinet is to be placed, locate a studding space 3 ft. from the floor and chip off plaster to the edge of a stud. Four feet from this point expose another stud. Level a line between the two, 2 ft. 4¾ in. from the

MATERIAL LIST

1 piece, 1⅛ by 3 in. by 8 ft., pine or fir, S4S, sanded.
1 piece, 1⅛ by 4 in. by 4 ft., pine or fir, S4S, sanded.
1 piece, 1 by 5 in. by 14 ft., pine or fir, S4S, sanded.
1 piece, 1 by 5 in. by 12 ft., pine or fir, S4S, sanded.
1 piece, 1 by 4 in. by 14 ft., pine or fir, S4S, sanded.
1 piece, ⅜ by 12 in. by 4 ft., pine or fir, S4S, sanded.
1 piece, ⅜ by 5 in. by 12 ft., pine or fir, S4S, sanded.
1 piece, ⅜ by 5 in. by 8 ft., pine or fir, S4S, sanded.
1 piece, ⅜ by 4 in. by 6 ft., pine or fir, S4S, sanded.
1 piece, ⅜ by 20 in. by 7 ft., three-ply pine or fir panel veneer.
1 piece, ⅜ by 16 in. by 7 ft., three-ply pine or fir panel veneer.
9½ pair, ¾ by ¾-in. hinges. 1 desk chain.
1½ pair, 2½ by 2½-in. loose-pin butts.

Cost of materials, about $12. Time to build, about 20 hours.

2½ by 2½-in. loose-pin butts, choosing a kind that can be closed backward to a right angle. Countersink the holes on the backs and put on wrong side out, which will bring the pin underneath the door, thus offering little hindrance to the opening of the lower drawer. Put a desk chain on the left end of the door.

Having chosen the place where the floor, and another 2 ft. 2½ in. above that. Plumb lines down the inside edges of the studs and remove the lath and plaster from the inclosed rectangle by cutting the

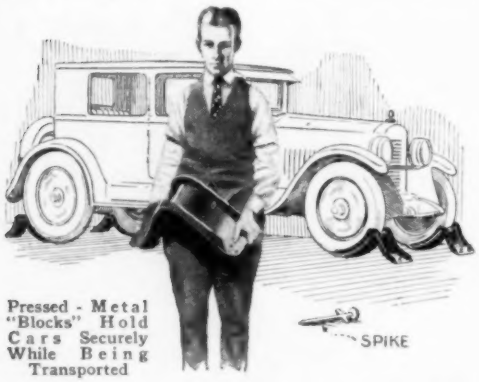
Here Is a Sewing Cabinet That Will Appeal to Every Home-Owning Housewife; It Provides a Place for Everything Used in Sewing and Mending

plaster with a cold chisel and laths with a compass saw. Set the cabinet in place, leveling carefully. Then nail the casings to the studding with eight-penny finish nails. If the plaster keys interfere with the cabinet going back to place, carefully break them off.

Removing the casing muntins, wedge the jambs, and nail through into the studding. Then nail the muntins permanently in place. Cut the curved depressions opposite each drawer and the bin for finger holds, and sand the cabinet preparatory to finishing. It is useless to putty nail holes or joints before the priming coat or stain is applied, since the dry wood will absorb the oil from the putty and loosen it.

Metal "Blocks" Hold Autos in Transit

A well-known automobile factory is now using a pressed-steel blocking brace



Pressed-Metal "Blocks" Hold Cars Securely While Being Transported

in loading autos on freight cars for shipment. Stronger than the old-time wooden blocks, these are easier to apply and remove, hold securely, and may be used over and over. A special type of spike is used, having a ½-in. shoulder under the head, which permits easy withdrawal and at the same time assures a secure hold. —Richard C. Tarr, Gloucester, Mass.

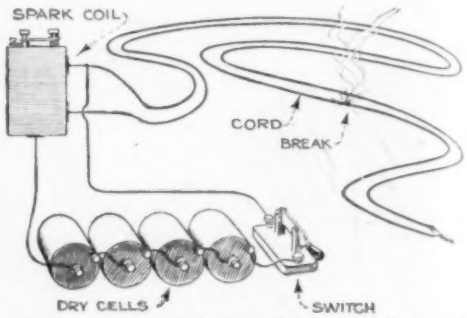
Tempering Small Articles Evenly

It is quite difficult to temper a lot of small springs or other small articles and have the temper equal in all parts of each piece. The following process will produce the desired effect: Obtain a small cup which is pressed from one piece of metal, or a pieced cup with hard-soldered seams. Partly fill the cup with some animal or fish oil. Petroleum products are not good on account of their volatility. The articles are heated to the usual color and plunged into the cup, which is to have sufficient oil in it to cover them. After being thus hardened, the cup with the oil and the articles is held over the fire until the oil takes fire and burns. After the temper has been drawn sufficiently, the cup is removed from the heat and a cover placed over it to quench the flames. When cool, the articles are removed. They will be found evenly tempered.

In tempering springs, I usually allow the oil to burn about six minutes before quenching. As the oil can be heated to only a certain temperature, the articles receive a perfectly even heat. If the oil is burned off from the article while it is only smeared with oil, some parts will be heated more than others. If a spring is made of piano wire, it will be greatly stiffened and improved by heating it to an even blue after it is formed. The reason for this is that when the wire is coiled the metal is full of strains which the heat removes. —J. H. Beebee, Rochester, N. Y

Locating Breaks in Electric Wiring

Many feet of valuable extension cord are wasted, and often an entire cord thrown away because of the difficulty of locating breaks in the wires concealed by the insulation. A simple method of locating these breaks is to connect the terminals at one end of the cord to the high-tension terminals of a Ford spark coil and short-circuit the other ends of the cord. If the battery terminals of the coil are then connected to three or four dry cells, arranged in series, as shown in the drawing, a hot spark will jump across the break in the wire, and its location can easily be detected by the noise and by the

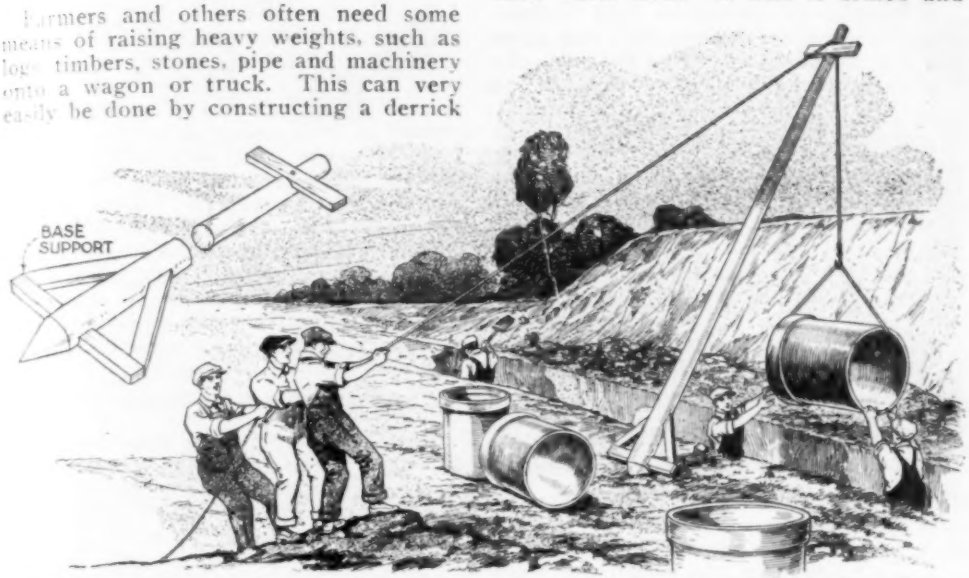


The Break in the Cord Is Located by the Noise and the Burning of the Insulation

burning of the insulation which will appear near the spot.—A. F. Gettelman, Madison, Wis.

Easily Made Derrick

Farmers and others often need some means of raising heavy weights, such as logs, timbers, stones, pipe and machinery onto a wagon or truck. This can very easily be done by constructing a derrick

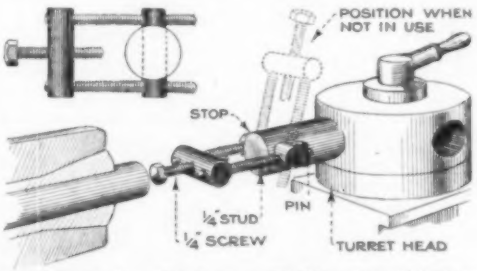


Simple Improvised Derrick for Farm Use Which Makes It Possible to Lift Objects of Considerable Weight

of the kind shown, which is both inexpensive and portable. One end of a sound log or 6 by 6-in. timber, about 15 ft. long, is sharpened and base supports nailed on as shown. At the other end a short crossarm is attached with bolts or nails. To raise a heavy object, the sharpened end of the log is placed in the ground, and a hitch is taken around the crossarm with a rope, which is fastened to the weight, and should be long enough to reach to the ground when the pole is raised. Lifting power is supplied by a truck, horse or a group of men. When the weight is raised to the proper height, it can easily be pulled onto a wagon.—A. Bereskin, Winnipeg, Can.

Releasing Tight Collets

Spring collets that stick are a common trouble on handscrew machines. This may be the result of several causes; the rod being used may be old and rough, or it may be bent or a shade too large for the collet. When a rod fails to come forward as the clutch is released, the best thing to do is to tap it lightly on the end projecting through the collet; this loosens the latter and allows the rod to feed forward to the stop in the turret. Sometimes this is a frequent occurrence, and many operators keep a hammer handy for tapping the rod back when it sticks. The drawing illustrates a better way. The stop itself has a ⅝-in. cold-rolled stock tapped at each end for ¼-in. studs, which carry another piece of ⅝-in. stock on their outer ends. A hole is drilled and tapped in the center of the outer piece for a ¼-in. screw. When a rod refuses to feed forward to the stop, the position of the latter being controlled by a stop on the machine, the device is dropped to a horizontal position where a pin driven through the stop holds it. The end of the rod is then tapped by bringing the turret forward, and as the collet releases it, the device is lifted back to the position indicated by the dotted lines, leaving the end of the stop free to locate the rod as usual. A device of this type enables the operator to keep up the regular swing of



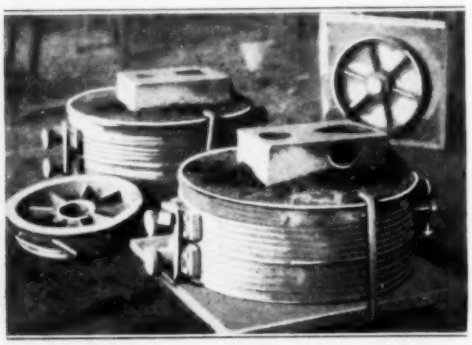
Attachment for Handscrew Machine for Releasing Stock That Sticks in the Collet

the turret, which is impossible when he must stop and pick up a hammer.

¶Oil paint has a tendency to wrinkle upon exposure to extreme cold but this may be prevented by adding a little turpentine to the paint.

Foundry Flasks from Truck Wheels

A foundry in the middle west received an order for some 24-in. wheels and gears but had no flasks suited to the job. As the order was likely to be repeated, it was



Old Automobile Rims Used as Flasks in Foundry

decided to make flasks specially adapted to that work alone. The ordinary round flask made of cast iron was rejected as it was too heavy. In the yard there were some old truck tires with the inside steel rim left on, and someone conceived the idea of stripping the rubber off and using these steel rings, as they were as near the diameter and width as could be desired. The old rubber was cut through with a metal band saw and was peeled from the rim. For ease in handling, particularly in turning over to dress the mold, a pair of iron trunnions were attached to each ring. The plan was so successful that later more of the flasks were made in another size for other work. Naturally the cost of the flasks was extremely low.—Donald A. Hampson, Middletown, N. Y.

Bending Ford Bendix Setscrew Washer

It is rather difficult to bend up the lip on the lock washer under the bendix-head setscrew on Ford-starter motors when replacing them. If a punch and hammer are used, the shaft turns at each blow and greatly lessens the effect, and an ordinary pair of pliers will not compress with enough force to bend the washers. A simple method is to grasp the partly bent lip on the washer and the screw head in a pair of pliers and turn the bendix until the pliers rest against the frame of the car. Now hammer on the opposite jaw of the pliers until the washer is bent, keeping a strong grip on the plier handles.

Shellac and Graphite Replace Gaskets

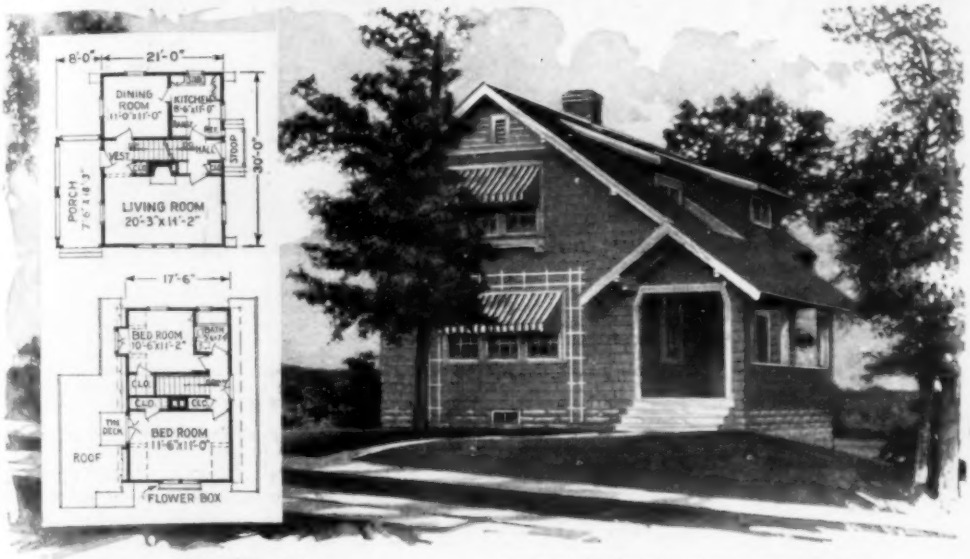
Powdered graphite and ordinary orange shellac, when mixed to the consistency of putty, form a solid sealing gasket, which resists heat and holds pressure. This mixture is also of use for small cracks in the water system around radiators, or various places where slight leakage occurs. If used to seal slight crevices, it should be made quite thin and worked into the crack with a putty knife.

Keeping Tractor Oil Warm in Cold Weather

Lubrication of tractors during cold weather presents the problem of keeping the oil thin. A good method of doing this is to arrange a tight-fitting box over the exhaust pipe, so that quite a bit of heat will be retained in the box. The oilcans are kept in it, and freely running oil will then be had in the coldest weather. For drying wet mittens and gloves this box is also a great convenience.—G. G. McVicker, North bend, Nebr.

Keeping Lubricating Oil Thin during Cold Winter Weather in a Box Built over the Exhaust Pipe

Maximum Comfort in Story-and-a-Half Home



Plan No. 5A1

Copyright, Architects' Small House Service Bureau

THIS is a one-and-a-half-story home, planned to meet the most exacting modern requirements and to provide comfort, convenience and a pleasing exterior at reasonable building outlay. There are five main rooms, bathroom, six closets, basement with heater room, and large light laundry.

The living room is everything that its name implies. It is a large, light room, with windows on three sides and a fireplace for winter comfort. It has the unusual advantage of opening both from the front and side hall. Notice, in fact, how easy it is to get from one part to another of this home.

Among the conveniences are the coat closet in the front hall; the broom closet and the general utility closet in the side entry. On the second floor there is a shelved linen closet. The kitchen is planned so all the fixtures are within easy reach. The ice box, though in the kitchen, is iced from outside. Both bedrooms have windows on two sides, and each has its own large closet. The bathroom is over the kitchen, an economical plumbing arrangement, as one stack can be used for both kitchen and bathroom.

The plan shown is drawn for lots facing east or south, while in the house pictured it has been reversed, making it suitable for lots facing north or west.

Home Builders' Questions

Q. Can anything be saved by doing without a general contractor and letting separate contracts for the different kinds of work? A. On paper it may seem less expensive to build with separate contracts. Practically in order to save anything, one must be sufficiently skillful in purchasing materials and in handling labor to offset the corresponding skill of the general contractor. Generally speaking, the hazard is not worth taking. A good contractor can build your house, put everything into it that you want, get it built better than you could, and then, after adding his profit, turn it over to you for less than you could by handling the subcontracts yourself.

Q. Is it necessary to have a set of specifications, if I have a complete set of plans? A. Yes. The plans show what is to be done. The specifications tell how it is to be done. The final cost of your house built without specifications may be much more than it would have been if you had had good specifications.

Q. What is the best way to turn a corner with a soldier brick course? A. Lay bricks at the corner flat.

Q. What is the cause of rust running down the kitchen wall from the hole where the vent pipe from the gas range comes through the plaster? A. This is caused by the warm air from the gas range coming into contact with the cold walls of the pipe which condenses the moisture from this warm air. The difficulty can be overcome if a drip is run from the bend of the pipe so that the water of condensation drips onto the basement floor. It is very difficult to overcome this condition in an old house without unreasonable expense.

Q. Is it safe to build an eight-inch brick wall to a height of ten or twelve feet? A. An eight-inch brick wall laid of good bricks and in good mortar is a substantial wall in the height you mention.

QUESTIONS regarding home building addressed to this magazine will be answered by the Architects' Small House Service Bureau of the United States, Inc., controlled by the American Institute of Architects and indorsed by the department of commerce, United States government. Blueprints, specifications and material lists for the house shown above may be obtained at a nominal cost. Inclose self-addressed, stamped envelope for reply. If further information is desired send five cents and stamped envelope for a 24-page booklet explaining how the small home bureau functions and showing twelve sample plans.

WHAT YOU WANT TO KNOW

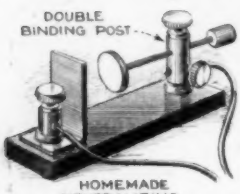


Fig. 1

Q. I am building a five-tube tuned r.f. set and would like to make my own neutralizing condensers. Can you suggest some simple means of doing this? A. A simple condenser of this type is shown in Fig. 1. A small brass strip is bent at an angle, as shown, and secured to the subpanel by means of a brass machine screw and binding post. The adjustable unit consists of a small copper disk, about the size of a penny, soldered to the end of a threaded brass rod or long machine screw. The upper hole in the double binding post is threaded to take this rod, and a hard-rubber or composition binding post head makes a good knob. Mount this unit on the subpanel at a convenient distance from the stationary unit.

Q. Please send me a schematic diagram of a simple one-tube set showing a wavetrap drawn in the circuit. A. The diagram for the circuit, including a wavetrap, is given in Fig. 2. There are several methods of using the trap, but the method shown is in common use, and adds greatly to the selectivity of the set.

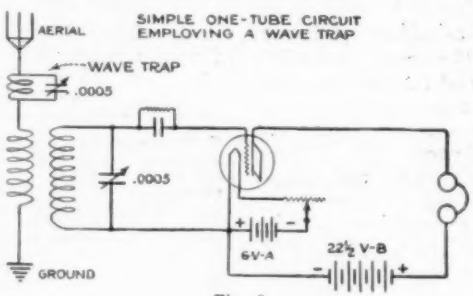


Fig. 2

Q. What are the approximate points on the dial where I can find the different wavelengths of the stations as they are listed? A. In most receivers the short-wave stations come in on the lower end of the dial. A receiver covering a range of 200 to 600 meters would tune in the 200-meter station at 0 on the dial, and 600-meter stations at about 100. At 50 on the dial, you could expect to find stations ranging around 300 meters.

Q. What ratio is best for the average two-step amplifier? I have several a.f. transformers of different ratios and want to use the best possible combination. A. For good results two 3½-to-1 ratio a.f. transformers work to the best advantage in the average set.

Q. What is the proper size of grid condenser to use with a three-circuit receiver? A. The grid condenser may be either .0005 or .00025 mfd. The latter capacity is commonly used in manufactured sets. Tubes vary, however, and it is best to try both values.

Q. I am having difficulty in getting a good ground. The soil here is very dry and sandy; please suggest some type of substitute ground. A. It is almost impossible to get a good ground in such soil. A simple counterpoise substitute can be made by stringing one or two wires under the aerial a few feet above the ground. A lead is taken from the counterpoise in the same manner as from the aerial and goes to the ground post on the set. The counterpoise acts as a countercapacity giving a condenser effect between the two, and makes a very effective substitute.

Q. What is the best type of wire to use for an aerial? A. Copper wire should be used; if this can be obtained in the enameled form it would be ideal as corrosion would be prevented. Use either No. 14 or 12 gauge wire, or standard antenna wire of the stranded type.

Q. I live in an apartment house and there are several aerials on the roof. One of them parallels my aerial and is about two feet away; will this interfere with my set? A. There will be no interference unless either your set or your neighbor's is of the regenerative type; then, there will be interference due to the radiation qualities of this type of circuit.

Q. What amperage should a fresh dry cell have? There seems to be a difference of opinion among the dealers here. A. Some makes of No. 6 dry cells test 30 amp., others from 17 to 22. A pamphlet can be obtained from the manufacturer specifying the amperage. Some of the high-resistance types will test low, although they may be fresh and in first-class condition. If a voltmeter is connected across the socket terminals of the set, and the rheostats turned up to the best operating point, the voltage reading should be up to the specified voltage for the tubes. If less, renew the batteries. The tubes should be run against voltage rather than against amperage.

Q. I have several of the old type UV-201A tubes with the brass base. I want to remove the base for an experiment; how can I do this? A. Hold the brass base over a flame as shown in Fig. 3. Slowly rotate the tube and when the sealing compound has melted, the base can be removed.

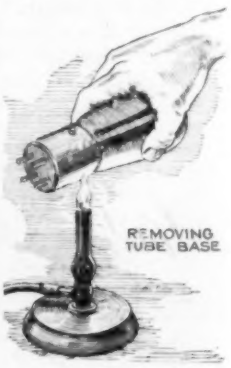


Fig. 3

IN accordance with the editorial policy of this magazine never to accept compensation in any form for what appears in our reading pages, and also to avoid all appearance of doing so, we are obliged to omit the name of the maker or the seller of any article described. This information, however, is kept on file and will be furnished free, by addressing Bureau of Information, Popular Mechanics Magazine, Chicago. [Editor.]

The Eveready Hour

LIKE the fabled ship in which Jason brought home the enchanted fleece of gold, the Eveready Hour brings a rich treasure of entertainment to charm the harbor-homes of its hearers.

Inaugurated two years ago, the Eveready Hour was an adventure in broadcasting—an hour of connected entertainment, uninterrupted by the frequent injection of the name of the broadcaster.

Many of these programs have become famous. Thousands of letters voice the appreciation of our audience and ask for repetition of favorites. We make no requests for these letters, but they mean much to our artists and to us, and are of great value in helping us in our efforts to arrange programs of a distinctive nature and pleasing to the vast audience.

Radio has already become a highly specialized art worthy of the most scrupulous code of ethics, and the Eveready Hour represents a sincere effort to pioneer in providing the most acceptable form of radio entertainment.

Eveready programs cover a wide range of entertainment and human interest, transporting us to periods of wholesome simplicity; to barren islands where marooned sailors meet adventure, starvation and death; to battle-scarred France with singing doughboys; to emotional heights by telling with music the stories of the seasons; and to memories of yesteryear aroused by old ballad and musical comedy favorites.

Eveready Hour begins at 9 p. m. each Tuesday night, Eastern Standard Time.

NATIONAL CARBON COMPANY, INC.
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WJAR–*Providence*
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WTAG–*Worcester*
WFI–*Philadelphia*
WGR–*Buffalo*
WCAE–*Pittsburgh*
WSAI–*Cincinnati*
WWJ–*Detroit*
WOC–*Davenport*
WEAR–*Cleveland*
WCCO { *Minneapolis* / *St. Paul*
WGN–*Chicago*
KSD–*St. Louis*

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Radio Batteries
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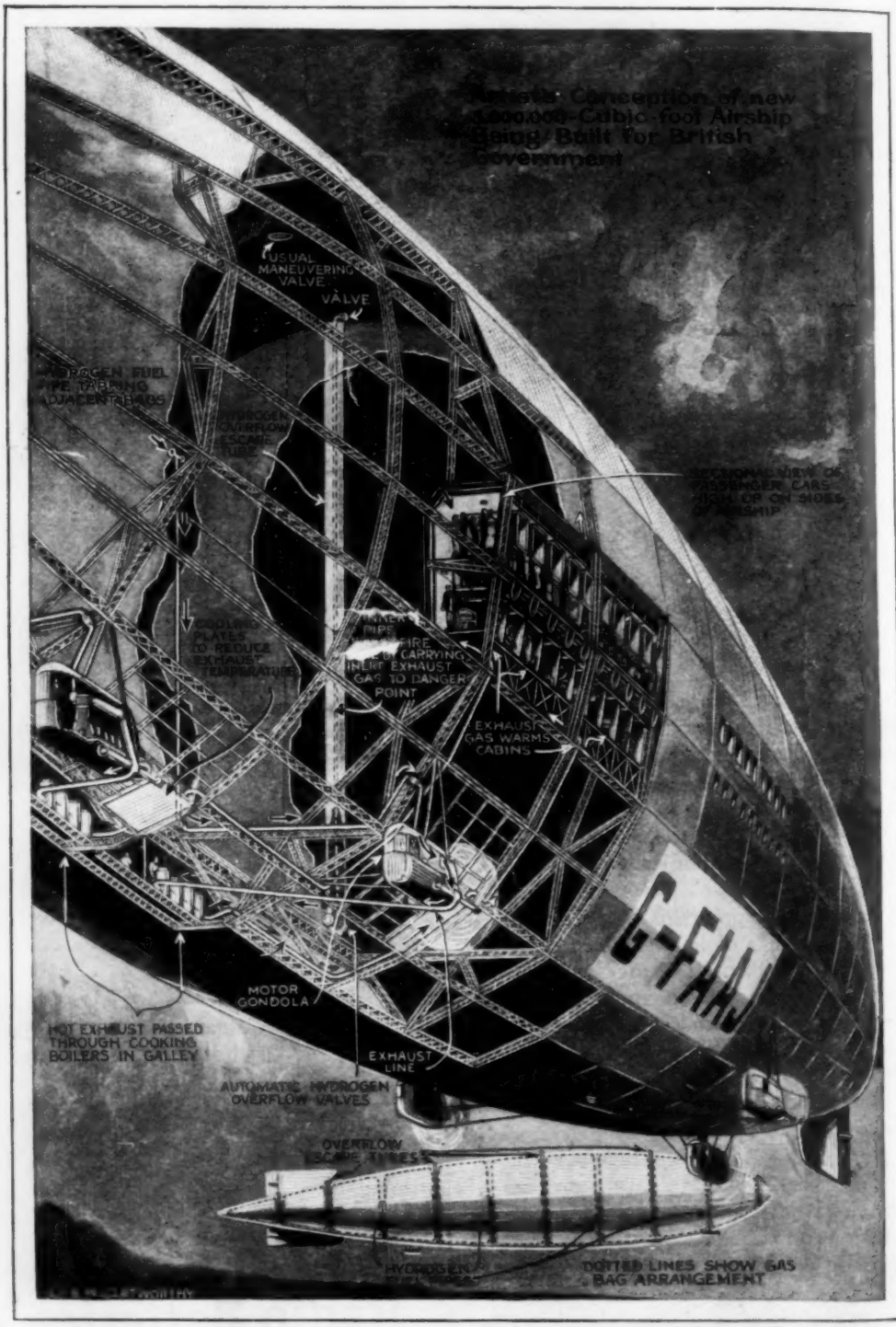
77


Artist's Conception of new 5,000,000-Cubic-foot Airship Being Built for British Government
USUAL MANEUVERING VALVE
VALVE
HYDROGEN FUEL PIPE TUBING ADJACENT BAGS
HYDROGEN OVERFLOW ESCAPE PIPE
COOLER PLATES TO REDUCE EXHAUST TEMPERATURE
EXHAUST PIPE
PIPE CARRYING INERT EXHAUST GAS TO DANGER POINT
EXHAUST GAS WARMS CABINS
SECTIONAL VIEW OF PASSENGER CARS SHOWN UP ON SIDE OF AIRSHIP
G-FAAJ
MOTOR GONDOLA
HOT EXHAUST PASSED THROUGH COOKING BOILERS IN GALLEY
EXHAUST LINE
AUTOMATIC HYDROGEN OVERFLOW VALVES
OVERFLOW ESCAPE PIPES
HYDROGEN FUEL PIPES
DOTTED LINES SHOW GAS BAG ARRANGEMENT

England Is Seeking a Way to Make Hydrogen Gas Safe for Airships by Surrounding It with a Layer of Burnt-Out and Inert Exhaust Gases from the Motors of the Ship—See Page 204